9950-320

PHASE I OF THE NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM

(NASA-CR-163225) PHASE 1 OF THE NEAR TEAM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM. APPENDIC C: PRELIMINARY DESIGN DATA PACKAGE. VOLUME 2: APPENDICES Final Report (Fiat Research Center) 124 p G3/85

N80-28251

Unclas 22368

FINAL REPORT

APPENDIX C: PRELIMINARY DESIGN DATA PACKAGE

Volume II: Appendices

Prepared for

JET PROPULSION LABORATORY

by

CENTRO RICERCHE FIAT S.p.A.

Orbassano (Turin) - ITALY

The research described in this publication represents the third of the several Tasks of the "Phase I of the Near Term Hybrid Passenger Vehicle Development Program" being carried-on by Centro Ricerche FIAT (CRF) on Contract No. 955187 from the Jet Propulsion Laboratory, California Institute of Technology.

Turin, September 11, 1979

This Report, prepared by:

R. Piccolo of CRF

has been issued in conformance to the following specifications:

JPL Contract No. 955187
Exhibit No. I Jan 16, 78
Exhibit No. II Dec. 1, 77
Contract Documentation - Phase I
Data Requirement Description No. 3

LIST OF CONTENTS

A.1 APPENDICES (SECTION 1: BACKGROUND INFORMATION)

Subcontractors Final Report on the Phase I

A.3 APPENDICES (SECTION 3: METHODOLOGY DESCRIPTION)

LIST OF TABLES

LIST OF FIGURES

APPENDIX A.1-1

HYBRID VEHICLE SODIUM-SULPHUR-BATTERY

Contribution of BBC for JPL Hybrid Vehicle
Contract No. 955187

K. Liemert
Brown Boveri & Cie A.G.
Central Research Laboratory, Heidelberg

1. INTRODUCTION

Na-S/batteries, when fully developed, are believed to be suitable for the propulsion of electric vehicles because of

- High energy density (Wh/kg and Wh/l)
- High power density (W/kg and W/l)
- Low price
- High cycle life
- High availability of the reactants.

A Na-S/battery consists of many series-parallel connected cells, a heat insulation and a temperature control system. A single cell contains the two molten reactants Sodium and Sulphur (or Na_2S_x if discharged), the beta-alumina solid electrolyte tube separating the reactants and the cell case. The operating temperature amounts to 285 °C to 350 °C. The design and the problems of Na-S/cells and Na-S/batteries are described in more detail in (1) (*).

2. STATE OF DEVELOPMENT

Our present cells show the following characteristics:

Length of ceramic tube:	200	mm
Ceramic outer diameter:	25	mm
Length of the cell:	235	mm
outher diameter of the cell:	37	mm
Cell weight:	460	g
Capacity:	40	Ah
Open circuit voltage:	2	V
Internal resistance:	$\leq$25	m
Maximum current:	40	A

(*) Numbers in parentheses designate Reference at end of section.

Maximum power:	40	W
Energy at maximum power:	40	Wh
Current at 5 hours discharge:	8	A
Power at 5 hours discharge:	14.4	W
Energy at 5 hours discharge:	72	Wh
Efficiency (E_{out} : E_{in}) at 10 hours charge:	0.88	

A battery with 96 of an earlier type of cells has been built (Fig. A.1-1.1) (2).

The performance of the battery was as expected from single cell experiments. Batteries with the new type of cells will be built and tested in 1979/80. Further efforts will be directed towards improving the following properties:

Life cycle of single cells
Electrolyte tube and cell dimensions
Safety
Energy and power density
Efficiency of heat insulation
Advanced technology for mass production.

3. Na-S BATTERY FOR A HYBRID VEHICLE

The dimensions for a battery to be installed between the back wheels of a hybrid vehicle should not exceed the following dimensions:

Length:	900	mm
Width:	1200	mm
Height:	400	mm

The following electrical data should be achieved:

Peak power:	$\geq$ 32 kW for 1 minute
Power:	15 kW for 10 minutes
Open circuit voltage:	$\leq$ 84 V

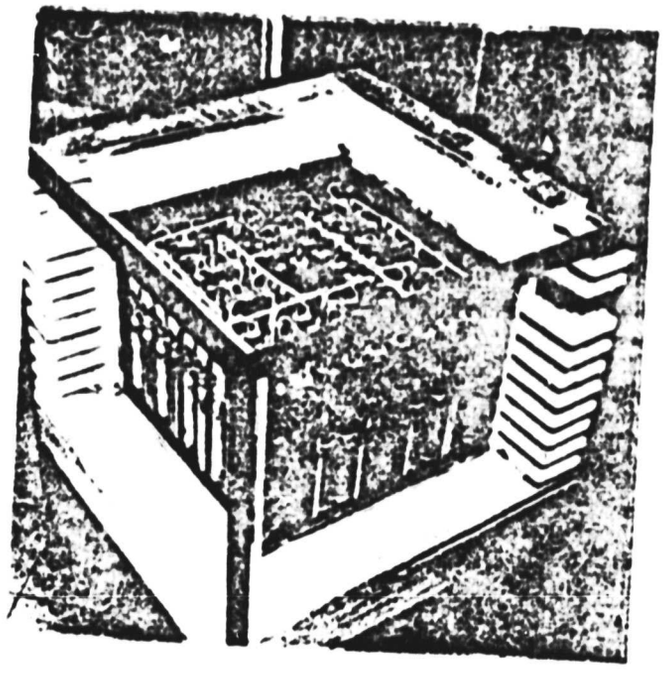


FIG. A.1 - 1.1 – EXPERIMENTAL BATTERY WITH 96 CELLS

The weight should not exceed 300 kg.

If possible the battery should contain 12 separate strings. The connections for the different strings should be leaded separately to the outside of the battery and it should be possible to switch them off after charging or discharging.

The battery has to resist the normal stress which occurs during operation of the vehicle.

The normal accelerations during operation at the car do not exceed 1 g as can be seen from Fig. A.1-1.2 (3).

4. BATTERY DESIGN FOR THE HYBRID VEHICLE

4.1 Cell

The cell design for the hybrid vehicle battery is based on the cell described in chapter 2.

The dimensions of the cell were chosen in a way that high power density results at low discharge times of less than one hour (curve △ of Fig. A.1-1.3).

By extrapolation of the cell data mentioned above, which have been already achieved and by assuming that a slight improvement with respect to internal resistance can be attained (2 Ω cm^2) the following data for a hybrid vehicle cell will be obtained:

Length of ceramic tube:	250	mm
Outer diameter of ceramic tube:	25	mm
Length of the cell:	285	mm
Outer diameter of the cell:	37	mm
Cell weight:	560	g
Capacity:	52.5	Ah
Open circuit voltage:	2	V
Internal resistance:	13.3	mΩ
Maximum current:	75	A
Maximum power:	75	W

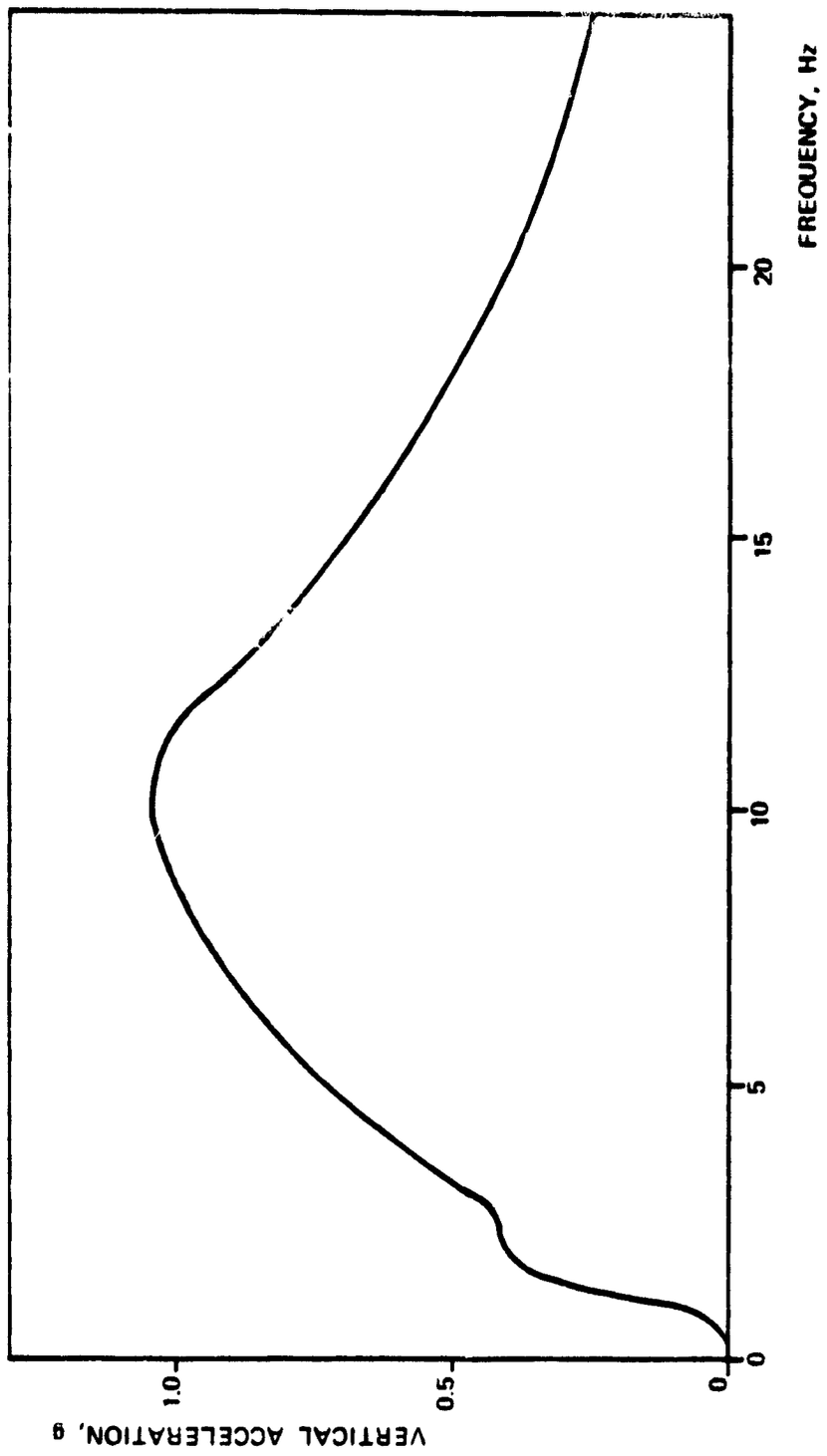


FIG. A.1-1.2 – VERTICAL ACCELERATION IN RELATION TO FREQUENCY.
CAR SPEED: 60 km/h ON MACADAM ROAD

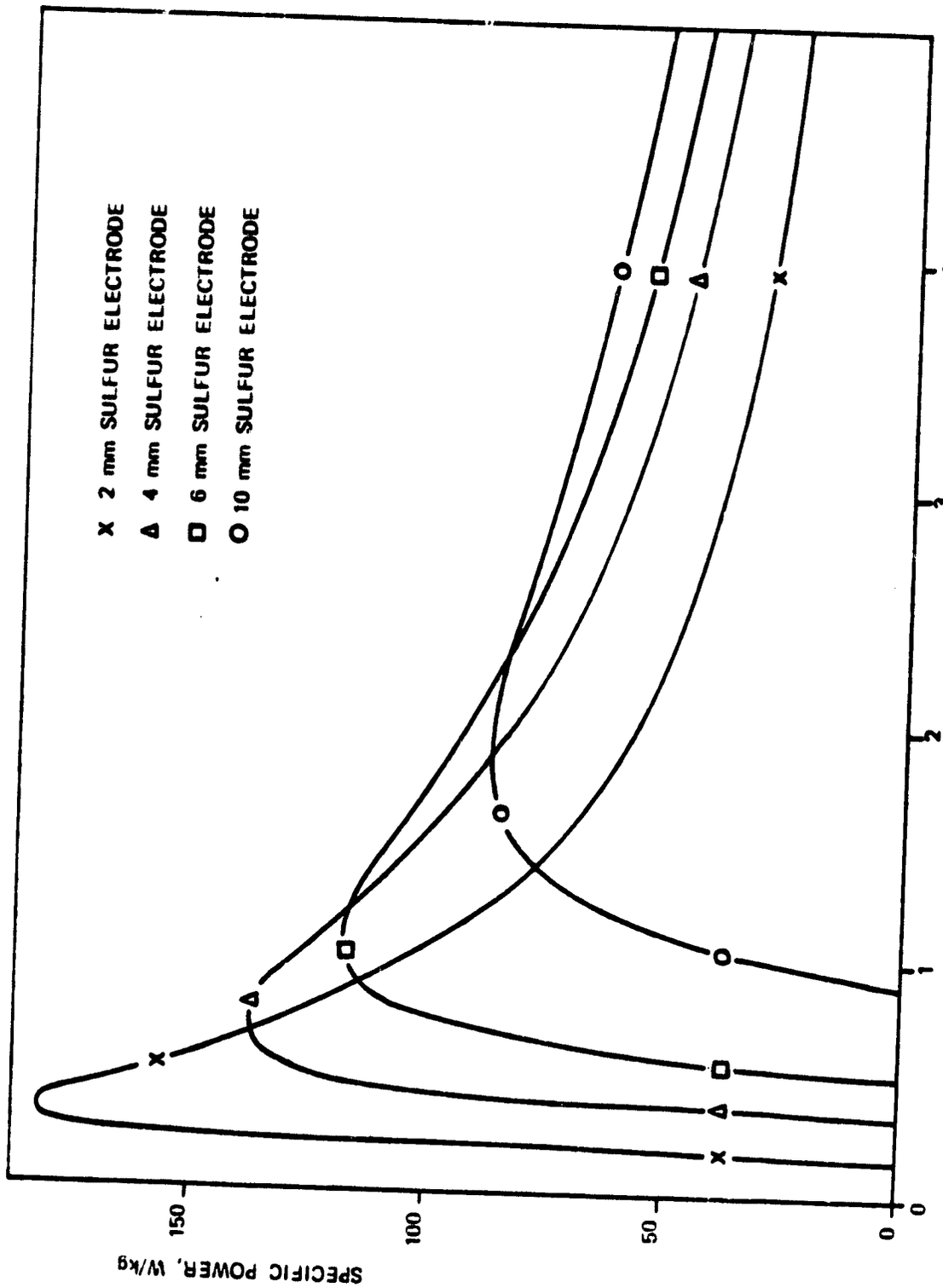


FIG.A.1-1.3– SPECIFIC POWER IN RELATION TO DISCHARGE TIME OF A CELL

Discharge time at max. power:	0.7	h
Energy at max. power:	52.5	Wh
Efficiency (E_{out} : E_{in}) at charging times of about 10 hours:	0.45	
Current at 5 hours discharge:	10.5	A
Power at 5 hours discharge:	19.5	W
Operating voltage at 5 hours discharge:	1.86	V
Energy at 5 hours discharge:	97.7	Wh

4.2 Battery

The battery consists of 24 modules. Each module contains 18 series connected cells. Two series connected modules form a string. The battery consists of 12 strings. By parallel connection of these strings a battery with the following data will be obtained:

Number of cells:	432	
Length:	900	mm
Width:	1100	mm
Height:	400	mm
Weight overall:	320	kg
Capacity:	630	Ah
Open circuit voltage:	72	V
Internal resistance:	39.9	mΩ
Maximum current:	900	A
Maximum power:	32.4	kW
Operating voltage:	36	V
Energy at max. power:	22.7	kWh
Discharge time at max. power:	0.7	h
Efficiency (E_{out} : E_{in}) at charge time $\geq$ 10 hours:	0.45	
Maximal charging voltage:	105	V
Two hours current:	315	A

Two hours power:	18.7	kW
Operating voltage	59.4	V
Two hours energy:	37.4	kWh
Efficiency (E_{out} : E_{in}) at charge time $\geq$ 10 hours:	0.75	
Five hours current:	126	A
Five hours power:	8.4	kW
Operating voltage:	67.0	V
Five hours energy:	42.2	kWh
Efficiency (E_{out} : E_{in}) at charge time $\geq$ 10 hours:	0.9	

4.3 Insulation

The double walled casing of the battery containing the heat insulation between the walls consists of two parts. Both parts are fixed at the rack of the vehicle. The battery is designed such that the upper part has a super insulation and is welded to the rack of the vehicle. The lower part bears the modules.

Conventional insulation is used for the lower case. This part can be disconnected from the rack for maintenance purposes.

The replacement of module can be performed in a few minutes. The casing with the insulation is necessary to keep the battery at operating temperature for a period of time of approximately 24 hours during which the battery might not be charged or discharged. If the battery is not operated for several days it must be heated up before utilization.

5. SAFETY

The most severe hazard for a cell is cracking of the electrolyte tube. Cells have been in operation the outer casing of

which remained undestroyed when such a case occured. However further safety tests are necessary to get statistical evidence for a high probability to have save cells.

Shock tests with single cells have shown that no damage occurs up to accelerations of 150 g.

Safety tests with complete batteries will be performed in the next years. This tests include experiments concerning failure propagation in the battery and severe accidents where the battery casing and cell casings are mechanically destroyed.

6. LIFE CYCLE

Our present cells have been operated up to 400 cycles. The average life cycle amounts to 250 cycles. It is expected that the average life cycle can be increased to 600 cycles in 1986 and more than 1000 cycles in the nineties.

7. BATTERY PRICES

Mass production is scheduled to start in 1986. According to our present estimations a battery price of approximately 10000 to 15000 DM may be achieved at this time.

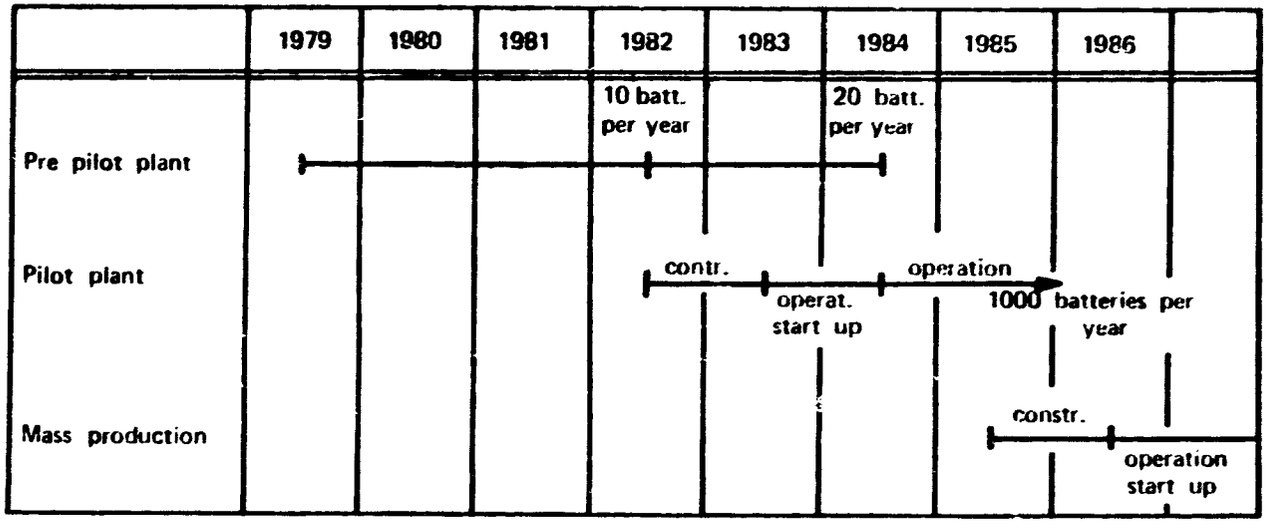
It is expected that this price will decrease in the nineties to a value between 5000 and 8000 DM.

8. MANUFACTURABILITY

We expect that the pilot plant production can be started in 1984 and that the mass production can be started in 1986.

The following Table A.1-1.1 shows the time schedule for the Na-S battery production.

TABLE A.1-1.1 – TIME SCHEDULE FOR THE Na/S BATTERY PRODUCTION



LITERATURE

(1) W. Fischer u. B. Hartmann:
Die Natrium/Schwefel-Batterie. Ein Speicher für die Elektrotraktion und den Spitzenlastausgleich. ASR-Digest für angewandte Antriebstechnik, Heft Sept. 1978, 6. Jahrgang.

(2) W. Fischer und H. Meinhold:
Neue Ergebnisse mit Natrium/Schwefel-Batterie und Aspekte für ihren praktischen Einsatz. Elektrische Energie-Technik; 24. Jahrgang, 1979, Nr. 1.

(3) Information of FIAT, Febr. 1979.

APPENDIX A.1-2

A.1-2a Final Report No. 0566 July 13, 1979
A.1-2b Final Report No. 103 July 21, 1979

SUBCONTRACT MAGNETI MARELLI - CRF

UNDER JPL CONTRACT No. 955187

"NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM"
PHASE I

1. INTRODUCTION

For the purposes of the "JPL" Hybrid Vehicle project, Magneti Marelli has made available to FIAT, the leader of the group, its direct experience in the field of electrochemical accumulators.

This report summarizes the position in June 1979 concerning the choice made from the range of batteries suitable to the requirements, and discusses some of their electrical characteristics which can now be achieved on a large scale production basis.

In the light of results obtained in the laboratory on technical cells, the report forecasts the results obtainable using the same battery types, by 1985.

2. CHOICE OF THE BATTERY

The first type of battery to be considered was the Lead-Acid one, partly because we are familiar with this type but mainly because today it is one of the very few road traction battery systems produced industrially and therefore available at a competitive price and a known degree of produced reliability. Its design characteristics are by now so "firm" that the Lead-Acid battery is virtually the point of reference for all other types in more or less advanced stages of development.

Magneti Marelli has also started to develop the Nickel-Zinc type, after carefully investigating the possibilities of achieving performance levels clearly superior to those of the Lead-Acid type, in the near term and within a reasonable investment of resources.

3. LEAD-ACID BATTERY

Among the various types available for the "JPL" project, the one considered was a polypropylene monobloc battery specially designed for electrically-propelled road vehicles weighing less than 2 t approximately.

3.1. Physical characteristics

The space occupied (see Fig. A.1-2.1) is much the same as that of the Golf Cart type of battery and the present weight, 29 kg approximately, enables the battery to readily moved by one person using the special handgrips provided in the cover.

Also in the cover is a system of channels which, when the modules of the complete vehicle battery are connected together, enable the gases released to be suitably vented. This avoids the heavy corrosion which normally occurs in the battery container due to the out flow of sulphur and caused by the escaping gas, and to release safely the explosive H_2/O_2 mixture through a unique exit equipped with a flame interruption device.

The same channels can be used to top up the cells with distilled water. The construction of the cover is such that the ingress of water into a given cell is stopped once the desidered level is reached; in this way all cells have the same electrique level when the topping-up operation is complete.

3.2. Electrical characteristics

The 12V (nominal) battery module has a nominal capacity of 90 Ah when discharged in 5 hours; its nominal specific discharge energy at this rate is therefore 37 Wh/kg approximately.

Maximum specific power is 140 W/kg approximately and the duration is therefore about 400 effective cycles.

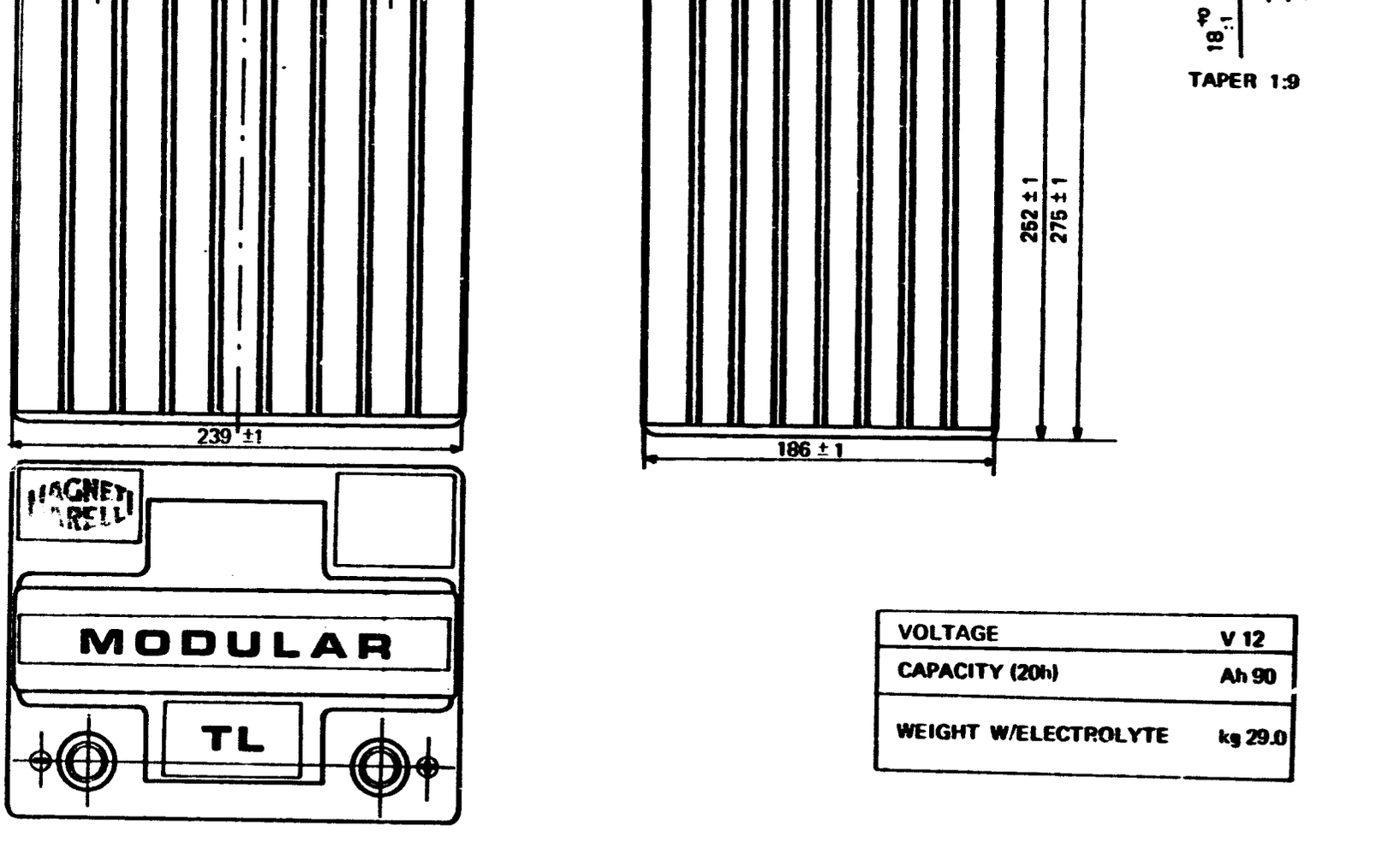


FIG. A.1-2.1– BATTERY SIZES

Results obtained in the laboratory on technical cells show that the performance of these battery modules can be improved, bringing about an increase in the specific energy and the deviation without affecting the specific power. The specific energy is noticeably increased (4.3 Wh/kg approximately in 5 hours) by decreasing the overall weight of the battery module has been kept to 25 kg.

The duration is increased to approximately 600-700 effective cycles. On Fig. A.1-2.2 the relationships between specific energy obtainable and peak power availability, for various mean discharge power levels are shown.

4. NICKEL-ZINC BATTERY

Magneti Marelli has started a research and development program on Nickel-Zinc batteries, which are considered as the most promising for near term traction applications.

At present our efforts are concentrated on producing single Zinc and Nickel electrodes; encouraging results have already been obtained, especially concerning duration in terms of cycles. We believe that future batteries shall have energy densities above 65 Wh/kg and peak power levels of 140 W/kg with a service life equating to that of present Lead-Acid types.

Research at Marelli is not yet sufficiently advanced to permit the supply of technical cells for Phase II of the project, nor to permit us to foresee large-scale production by 1985. For information only, we can state that our intention is to build a prototype Nickel-Zinc battery in a container similar to that used for the present Lead-Acid type (see para. 3), in order to achieve complete physical interchangeability between the two. The Nickel-Zinc battery will have a capacity of 340 Ah approximately and will weigh 23.7 kg; with a specific energy of about 70 Wh/kg approximately.

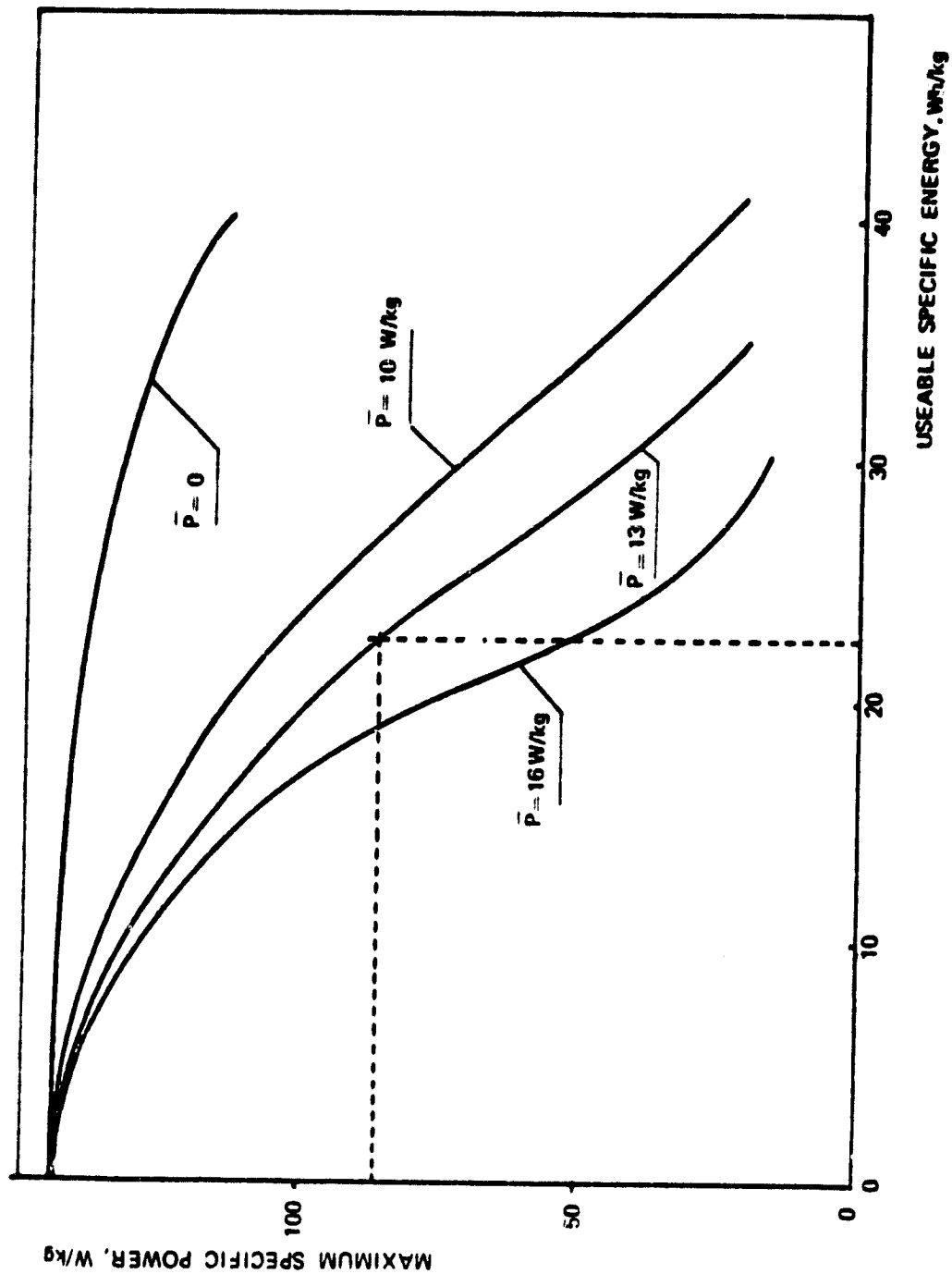


FIG. A.1-2.2 – MAXIMUM POWER VS USEABLE SPECIFIC ENERGY AS A FUNCTION OF AVERAGE POWER.

5. CONCLUSIONS

For the "JPL" Hybrid Vehicle project, Magneti Marelli have examined two types of battery, i.e. the Lead-Acid type and the Nickel-Zinc type.

The first type is already produced industrially and is known to be reliable. A new version of the modular battery has been designed, which can be manufactured in the near future, based on the results of laboratory tests on technical cells.

These results indicate that the battery may well be suitable for use on the specified type of vehicle.

For the Nickel-Zinc type, on the other hand, the present state of the art does not allow us to provide useable batteries within the time scale of the project. Nevertheless, the results obtained with single electrodes enable us to foresee batteries being produced in the future having the following characteristics:

- energy density over 65 Wh/kg
- peak power of approximately 140 W/kg
- duration comparable with that of present Lead-Acid types which would fulfil better the requirements of the JPL Hybrid Vehicle.

1. OBJECT OF PHASE I

Magneti Marelli have been given the task of identifying the possible types of power control that can be used on a hybrid vehicle.

After a preliminary study, Magneti Marelli have decided to adopt a type of power control and corresponding auxiliary equipment that are suitable for a separately excited DC motor.

This characterization has led to a preliminary design for the power circuits and for the battery charger together with an evaluation of weights, dimensions and efficiency.

As far as the power circuitry is concerned, a preliminary design has been made as well as the definition of weight and dimensions of each unit constituting it.

2. POWER CONTROL CHARACTERISTICS

After an evaluation of the various electric system alternatives, the Ni-Zn battery -DC motor combination has been selected by C.R. FIAT.

This choice implies a battery voltage of 96 V and a maximum available power of 38 kW.

Since the maximum power must be supplied even at low battery voltage, the maximum current is about 500 A.

During braking, the current can be about of the same value since the DC motor has commutating poles.

The field current reaches a maximum of 16.5 A at a voltage of 48 V and it must be possible to invert its direction in the shortest time for the braking phase. Braking must be regenerative down to zero speed, thus requiring a voltage boosting for speeds that are less than the basic one.

There must be a braking torque control, similar to that relative to the drive torque so as to modulate braking when the motor operates as a generator.

Ripple must be within 20% of the maximum current (i.e. 100 A peak-to-peak).

During field control operation a mechanical contact shall be able to short circuit the main chopper in order to reduce losses.

It is also necessary to guarantee operation in case of on board computer failure, by deriving a signal directly from the pedal unit.

3. CHOICE OF CONTROL DEVICE TYPE

Based upon previous experiences and evaluations carried out by Magneti Marelli in the design of control devices for electric vehicles, a control device has been chosen consisting of an armature chopper and of a field chopper-inverter. This choice, supported by many practical realizations, has proved to be the most valid and feasible.

The evolution and availability of high power transistors has made it possible to select these for the realization of both choppers, thus allowing an increase in the maximum working frequency and therefore the elimination of the smoothing inductance.

For regenerative braking, provision has been made so that additional choppers are not needed.

Regenerative braking is in fact obtained by modifying the circuit configuration so as to cut off the power supply to the motor (Fig. A.1-2.3). Adoption of a relay has advantageous since it is deenergized when zero current flows through the contacts so that there is no limitation to the number of opening/closing operations it can perform. This choice also allows to use the same armature chopper during normal running and braking conditions.

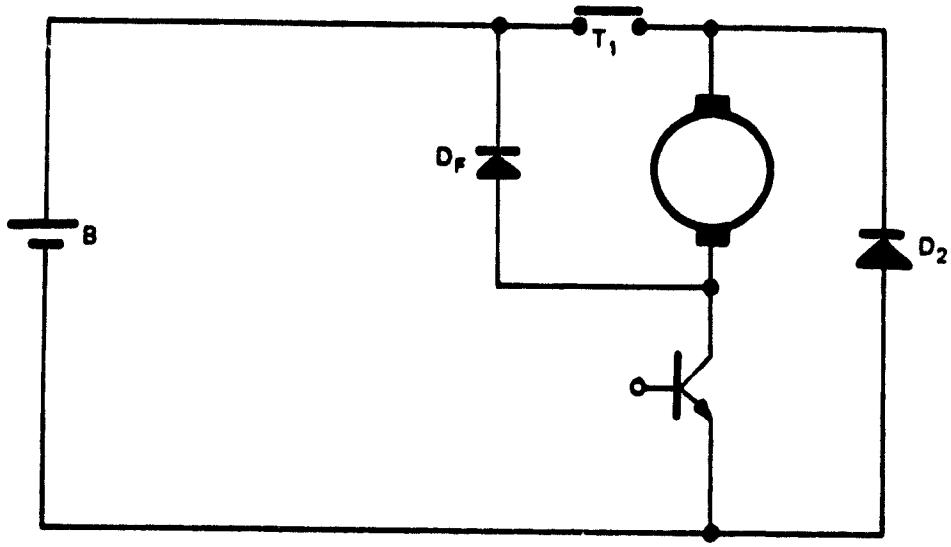


FIG. A.1-2.3 – ARMATURE CHOPPER ELECTRIC DIAGRAM

The control operates mainly by maintaining the armature current I_A within a range that includes a preset value of I_{SET}. The width of this range decreases non-linearly when I_A decreases.

This type of control, which is performed by means of a current feed-back, makes it possible to avoid the use of internal oscillators and frequency controls, by letting the system itself perform the function of oscillator, limited in this by appropriate non-linearities.

The same type of control is also applied to the field current I_F - as from Fig. A.1-2.4. Ripple, though, is maintained at much lower percentage values.

This control has been possible by using a type of electric motor with a field value calculated for a voltage of 48 V. From this it follows that, by supplying a voltage of 96 V, currents are produced which tend to values higher than I_{Fmax} and therefore allowing chopper operation also in the neighborhood of I_{Fmax}. Another advantage is that field inversion times are reduced by half.

4. OPERATIONAL DESCRIPTION

With reference to the block diagram of Fig. A.1-2.4, the on board computer sets a value of armature current I_{SET}.

The armature current oscillates between two threshold values: when the upper threshold is exceeded the chopper transistors are inhibited, whilst a value of current smaller than the lower threshold value makes the chopper conduct. The control thus establishes a ripple equal to 90 A peak-to-peak at a maximum frequency of 2 kHz and a current of 500 A.

For a 100 A current, a ripple value of 30 A peak-to-peak is set, resulting also in a maximum frequency of 2 kHz, because of the increased armature inductance.

This type of operation is valid until the basic motor speed

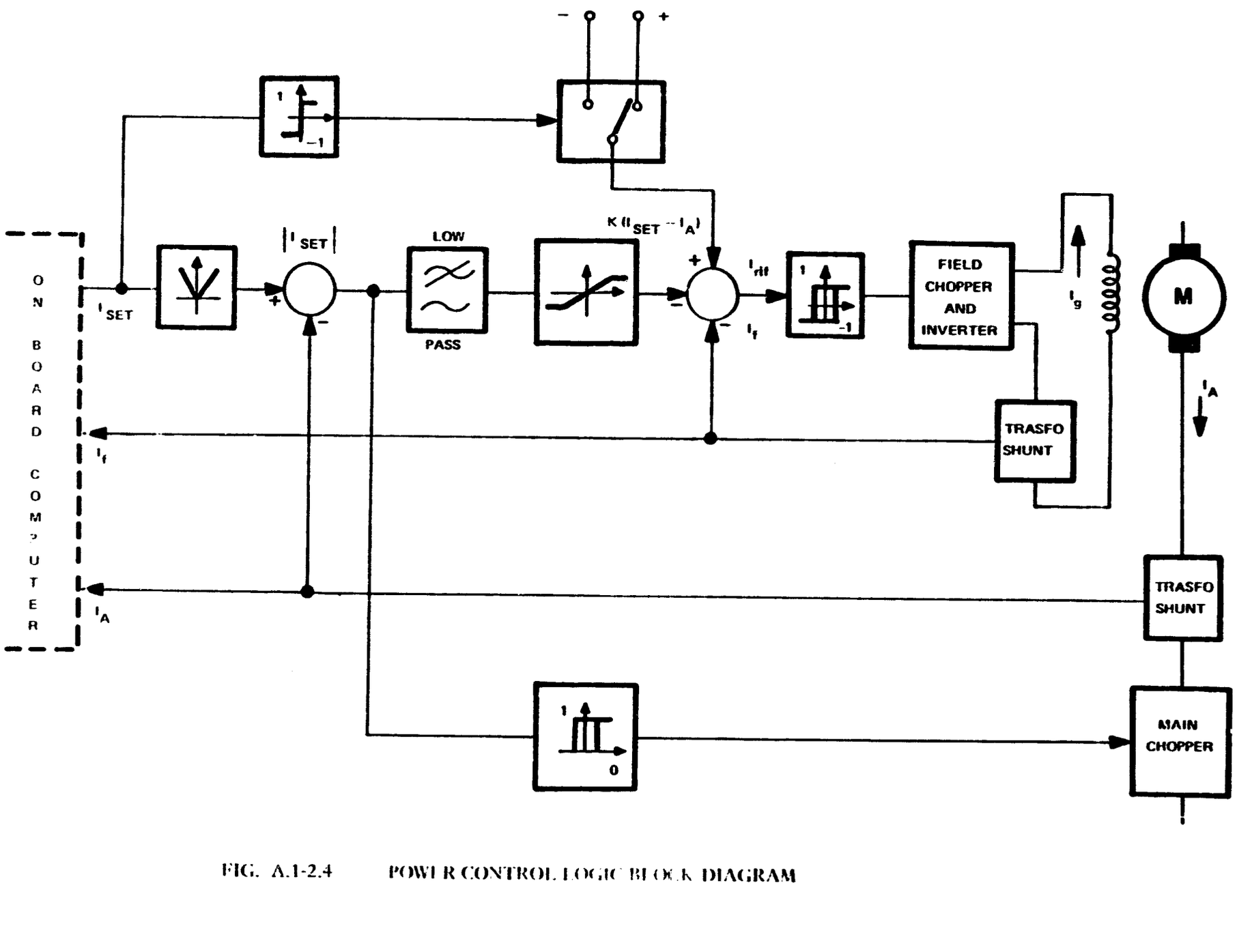


FIG. A.1-2.4 POWER CONTROL LOGIC BLOCK DIAGRAM

is reached; over this speed the control of the motor is performed by varying the field current.

The field control is obtained in similar way to the armature control; however field control implies a much lower ripple percentage value (0.1 A over 16.5 A maximum field current) resulting also in a much lower frequency value (300 Hz).

The electric diagram of the armature chopper is given in Fig A.1-2.3.

When the relay T_1 opens the polarity across the motor collector terminals reverses but the armature current maintaining its direction. Fig. A.1-2.5 shows the configuration corresponding to regenerative braking for speeds greater than the basic one ω_b.

The field must also be reversed and shall be controlled so as to limit the I_A and modulate the braking torque.

For values below the basic speed, the armature voltage is no longer capable of supplying current to the battery so that a voltage boosting must be produced in the motor coil, as given in Fig. A.1-2.6.

This circuit arrangement has been designed by Magneti Marelli that have also filed an Italian Patent.

The on-off pulses for the chopper are generated by the same logic which operates a comparison, with hysteresis, between the preset value of current and the actual current in the motor.

A more detailed operational description of the regenerative braking with reference to the block diagram of Fig. A.1-2.4 is given below.

The values of current preset by the on board computer become negative. The absolute values of these are compared with the armature current I_a. The sign detected by an ad hoc comparator, modifies the field reference current bringing it to its maximum negative value. The braking current goes to zero in a time interval shorter than that required for field inversion; thus, there is a very short elapse of time in which the armature current I_a is zero.

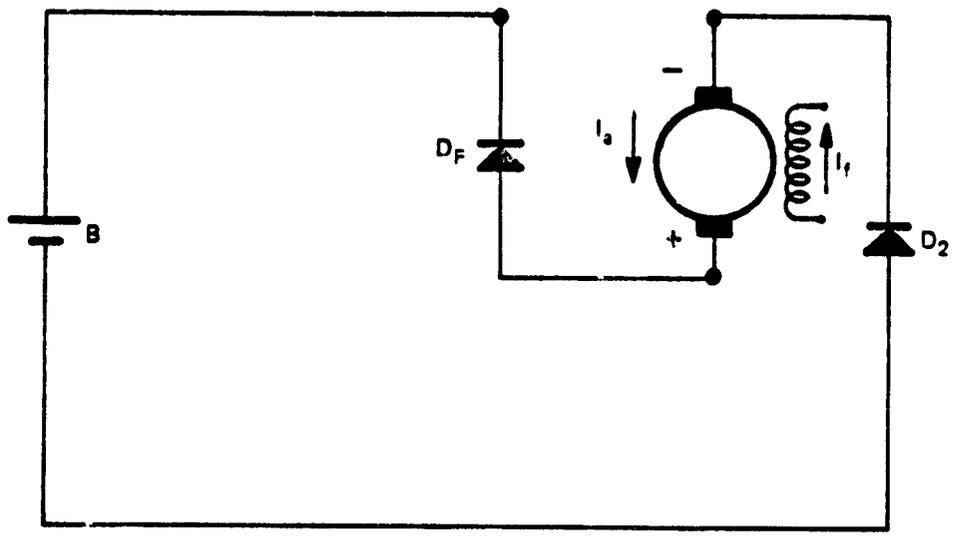


FIG. A.1-2.5—ARMATURE CHOPPER ELECTRIC DIAGRAM REGENERATIVE BRAKING CONFIGURATION FOR SPEEDS GREATER THAN THE BASIC ONE

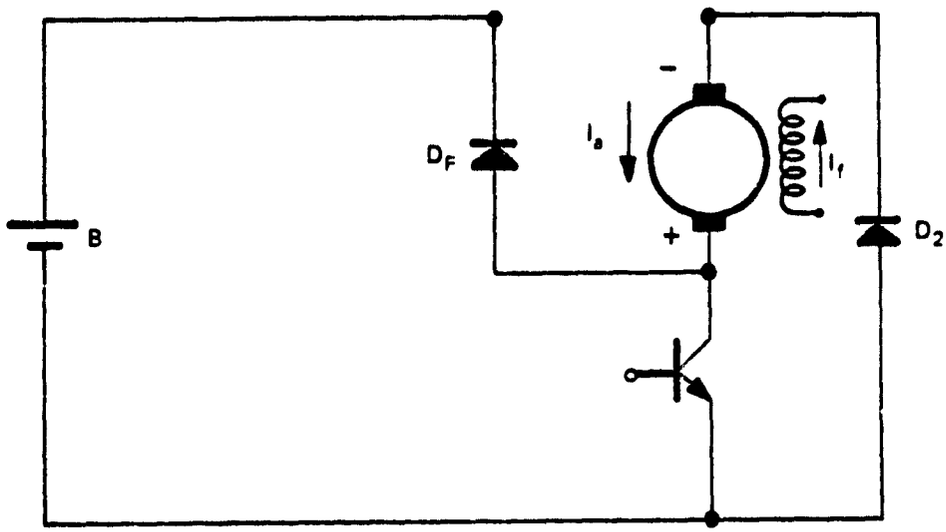


FIG. A.1-2.6 – ARMATURE CHOPPER ELECTRIC DIAGRAM. REGENERATIVE BRAKING CONFIGURATION FOR SPEEDS LOWER THAN THE BASIC ONE

It is during this time corresponding to $I_a = 0$ that the relay opens.

The on board computer, during inversion, shall maintain the value of I_{set} at zero until the field current has reversed and reached a prefixed threshold. Once this transient has extinguished and for speeds greater than ω_b, the armature current I_a settles at an absolute value greater than I_{set} and the $K (I_a - I_{set}) > 0$ error modulates the field weakening.

Therefore, during regenerative braking, for speeds greater than ω_b, the armature current I_a is controlled by varying the field current.

For values of speed below ω_b, the $(I_{set} - I_a)$ positive values short-circuit the motor armature by means of the main chopper; negative values of $(I_{set} - I_a)$ inhibit the chopper and the overvoltage which is produced allows transfer of the energy stored in the armature coil to the battery. This type of operation has proved successful for the more recent types of choppers produced by Magneti Marelli.

5. ARMATURE CHOPPER AND FIELD CHOPPER-INVERTER

For the realization of the main chopper, the Toshiba Giant Transistor 2SD648 have been considered which have the following characteristics:

Monolithic Darlington

400 A maximum continuous collector current

300 V V_{CEO} (SUS)

$T_{on} = 1\ \mu s$ typical

$T_{off} = 2\ \mu s$ typical.

Two transistors in parallel have been used, thus involving a considerable chopper oversizing with respect to the specifications. This oversizing might be reduced by the availability on the market of anclogous components or by the

production of a specific component manufactured, on request, by a specialized American Company. The maximum frequency has been set to 2 kHz so as to satisfy the TR constraints.

With reference to Fig. A.1-2.7, the use of two transistors in parallel implies the need for a current coupling that guarantees equal power dissipations in each transistor.

This is obtained by means of a mutual inductance so that transistor thermal run-away is avoided.

During operation at values above ω_b, i.e. when the duty-cycle is equal to 1, a by-pass relay short-circuits the chopper thus increasing efficiency and avoiding differences in currents that might occur during steady state functioning.

The two transistor bases are independently supplied by two drivers one of which can be inhibited by an OFF signal during battery charging operation (see Fig. A.1-2.7).

The two bases are protected by voltage limiters (clampers) that prevent the base voltage from going below -0.5 V.

The collectors of the two transistors will be fitted with antispike devices.

Four transistors have been used for the field-chopper, with the following characteristics:

- 18 A maximum continuous current
- 200 V V_{CEO} (sus).

In this way mechanical contacts are avoided for field inversion, thus increasing the overall reliability. Also, it allows to control chopper and field inversion operation. By alternatively switching on and off the two diagonals, chopper and current inversion operations are obtained in the shortest time possible.

Energy transfer to the battery is still performed via the two diodes down to zero current, whilst the transistors are inhibited although their bases would enable then to conduct.

At the end of energy transfer to the battery, the reverse voltage on the transistors reduces to zero and the transistors begin to conduct up to the preset value of reverse current; at this point, chopper operation begins again.

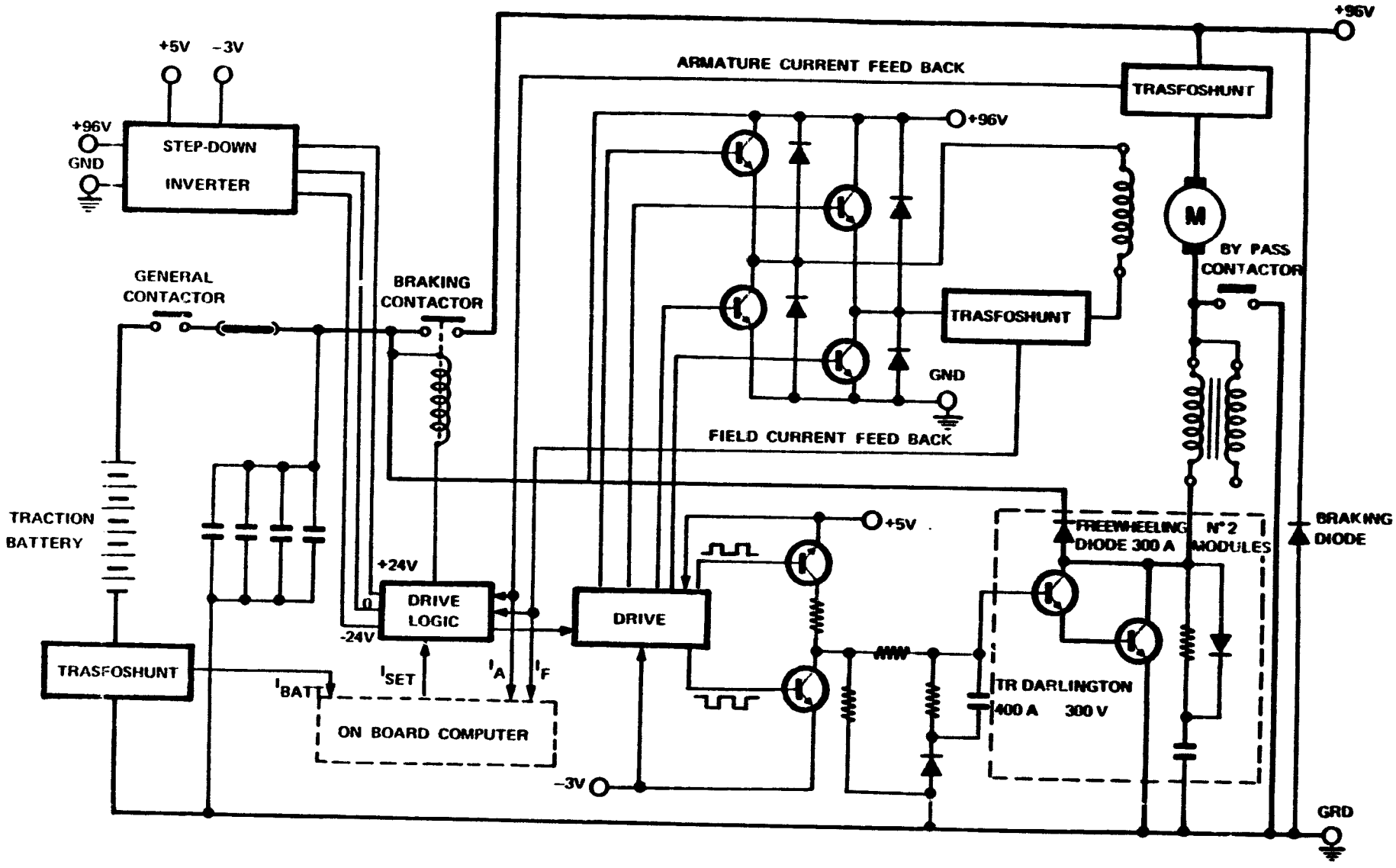


FIG. A.1-2.7 ARMATURE AND FIELD CHOPPER CIRCUIT

6. AUXILIARY EQUIPMENT

Main battery charger - Fig. A.1-2.8.

With reference to the battery charger circuit of Fig. A.1-2.8, the line voltage is rectified and chopped so as to obtain an average voltage value which is less than the minimum battery voltage.

After filtering, this voltage is applied to the main chopper via coil L_2. Only one power transistor is forced to conduct whilst the other is kept inhibited by the driver. At this point, via the chopper, coil L_2 begins to store energy; the armature current I_a starts increasing and when it reaches the upper threshold value the chopper opens and the energy stored in L_2 is transferred to the battery. When I_a reaches the lower threshold value the transistor is forced to conduct again. This type of operation is the same as for regenerative braking operation for values below ω_b. A negative I_{set} information is sent from the on board computer based upon the actual I_{batt}.

7. EVALUATION OF WEIGHTS, DIMENSIONS AND EFFICIENCY

The most relevant elements as far as weights and dimensions are concerned are:

- No. 2	heat dissipators for the power transistors, designed for a forced air speed of 4 m/sec	
	Dimensions (mm)	Weight (kg)
	177 x 127 x 128	5.6
- No. 3	500 A relays:	
	170 x 130 x 90	1.9
- No. 4	1000 μF, 200 V capacitors	
	120 x 52 Ø	
- No. 2	600 A trasfoshunts	
	150 x 130 x 80	2.5

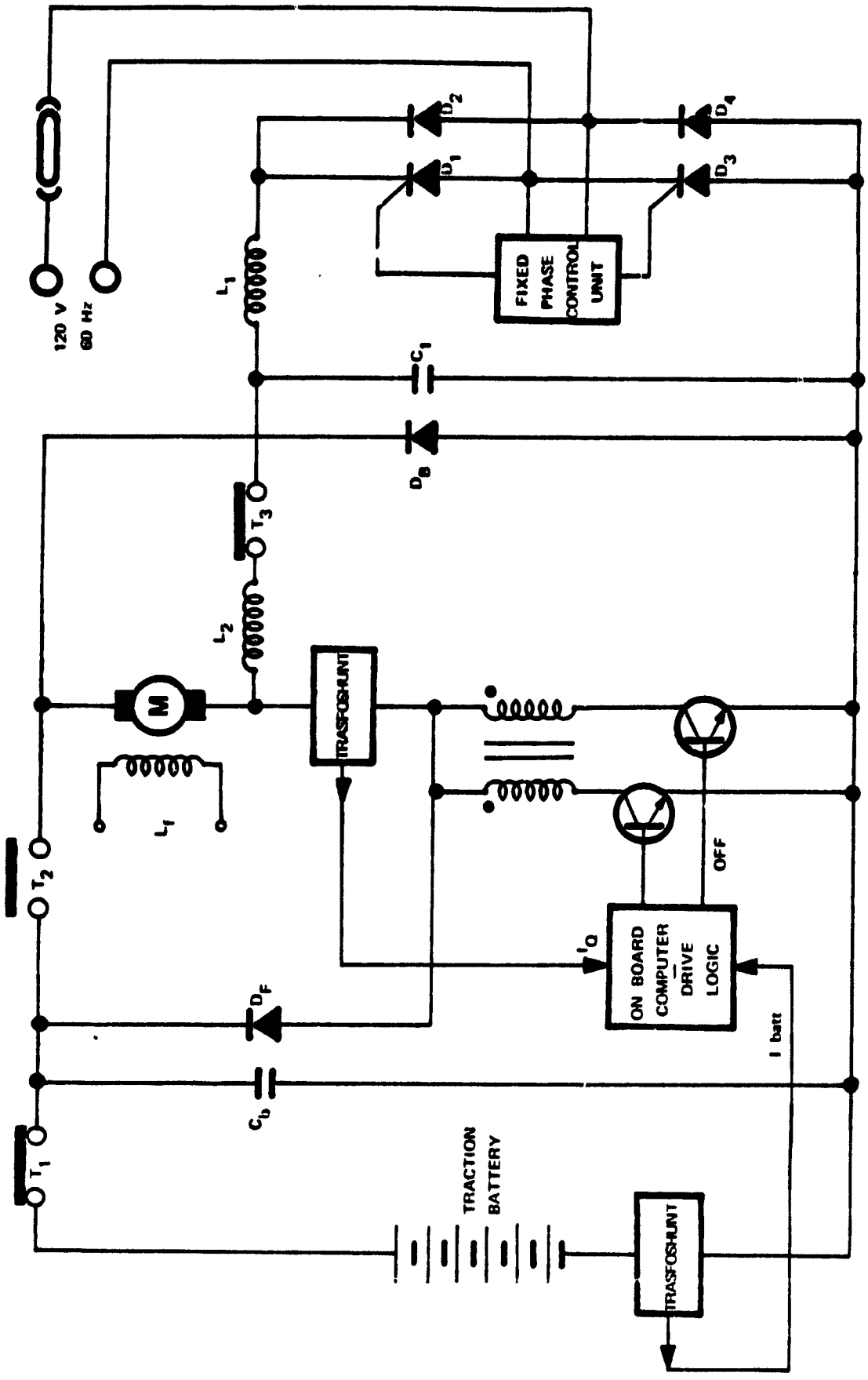


FIG. A.1-2.8 BATTERY CHARGER CIRCUIT

Overall dimensions (mm)	200 x 300 x 400
Total weight (kg)	22

The addition of container, control cards and connections bring to final overall dimensions of:

400 x 350 x 250 mm

and to a final total weight of

27 kg

The battery charger dimensions are:

150 x 100 x 200 mm

and the weight, including coils, capacitors and relay is:

4 kg

The field chopper expected efficiency is 0.96 under control worst condition i.e. with a duty cycle equal to 50% and an armature current of 500 A.

Battery charger efficiency is expected to be around 0.94.

APPENDIX A.1-3

Final Report No. CS 167/79 May 24, 1979

SUBCONTRACT PININFARINA - CRF

UNDER JPL CONTRACT No. 955187

"NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM"

PHASE I

PRELIMINARY DEFINITION OF THE VEHICLE ARCHITECTURE

General philosophy of body design

As far as the present state of the art is concerned relative to aerodynamics, a two-volume body design has proved more efficient than the three-volume type, geometric conditions being equal.

The general architecture of the vehicle body is as shown on drawing X, where account has been taken of mechanical parts and battery dimensions, number of passengers, capacity of the trunk and law regulations.

Drawing X (Fig. A.1-3.1)

It shows by means of three view, 1:5 scale, a first approach to the design that takes a previous research on aerodynamics by Pininfarina as a starting point and relative to a high-performance 4-passenger car, called "STUDIO CR 25".

Such a choice has been made because, for what concerns dimensions the body shape was capable of being adapted to the JPL design without deterioration in aerodynamic parameters.

Drawing J - 1:5 scale (Fig. A.1-3.2)

Definition by means of 4 views of the body shape considered as best (among the various ones presented as an alternative to this one) from functional aerodynamic, esthetic and legal points of view.

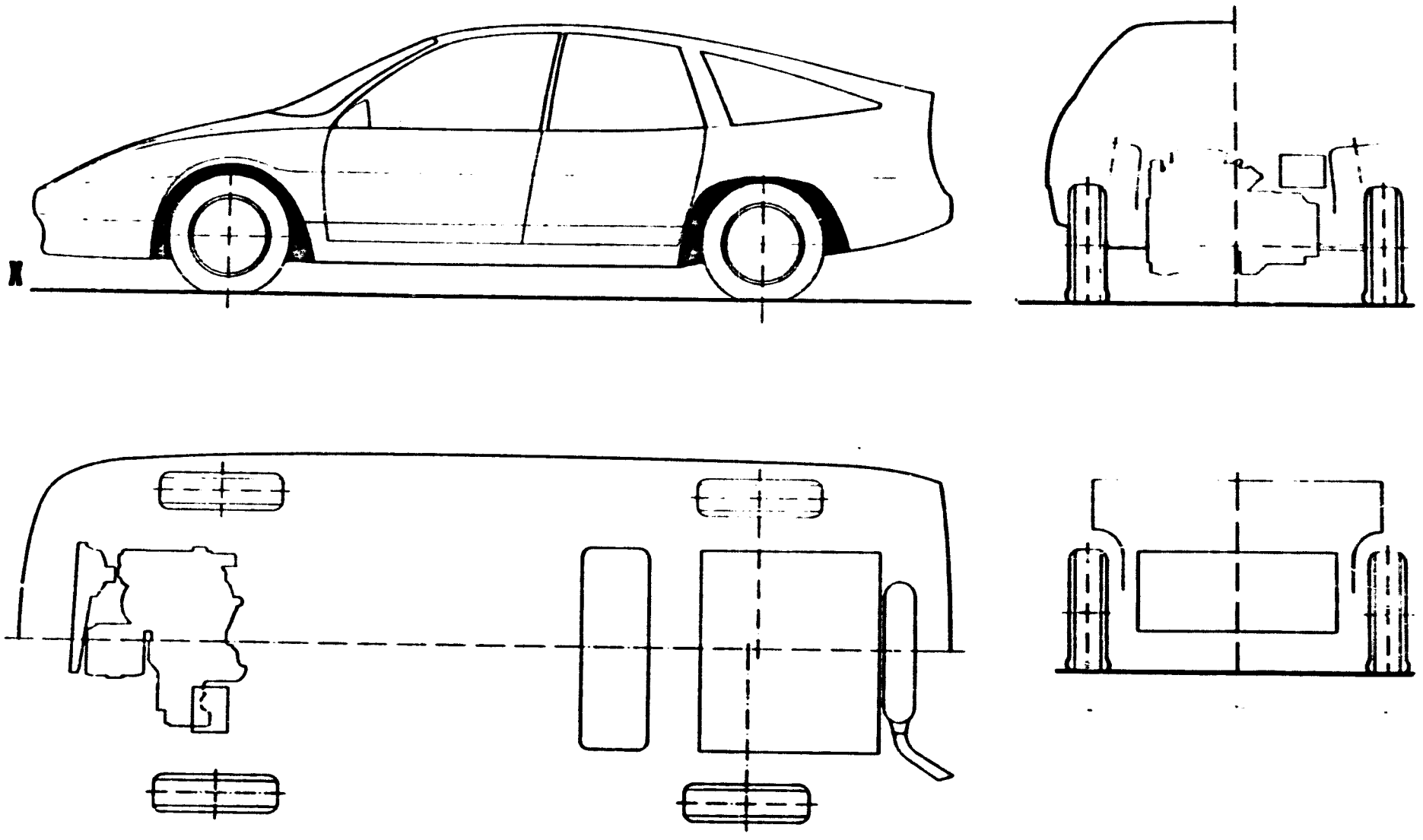


FIG. A.1-3.1 – BODY SHAPE – THE FIRST SOLUTION

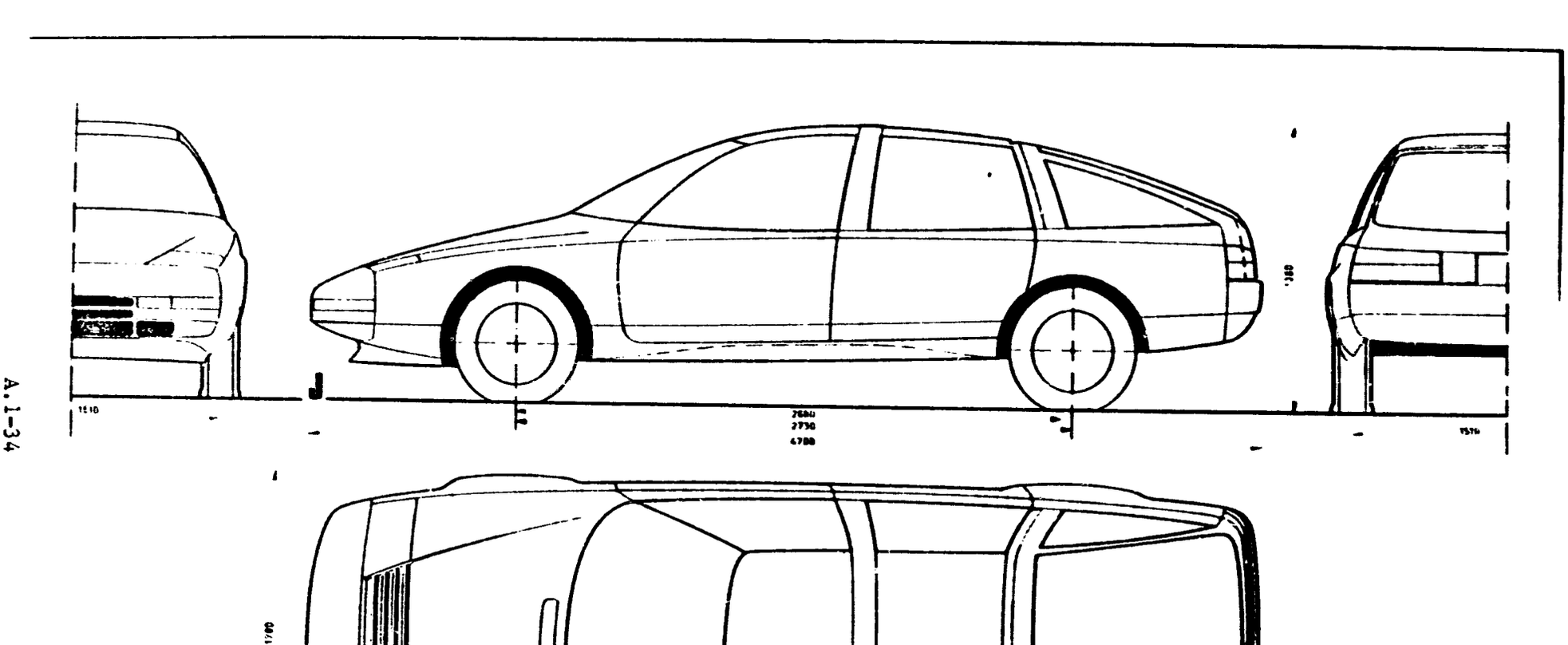


FIG. A.1-3.2 – BODY SHAPE – THE SELECTED SOLUTION

Drawing J with profile views (front, rear and three quarter front and rear) (Fig. A.1-3.3/4/5)

Drawing J - 1:5 scale - Four views showing the position of the "typical sections" (Fig. A.1-3.6).

Figures A.1-3.7 to A.1-3.17 - 1:1 scale showing the "typical sections".

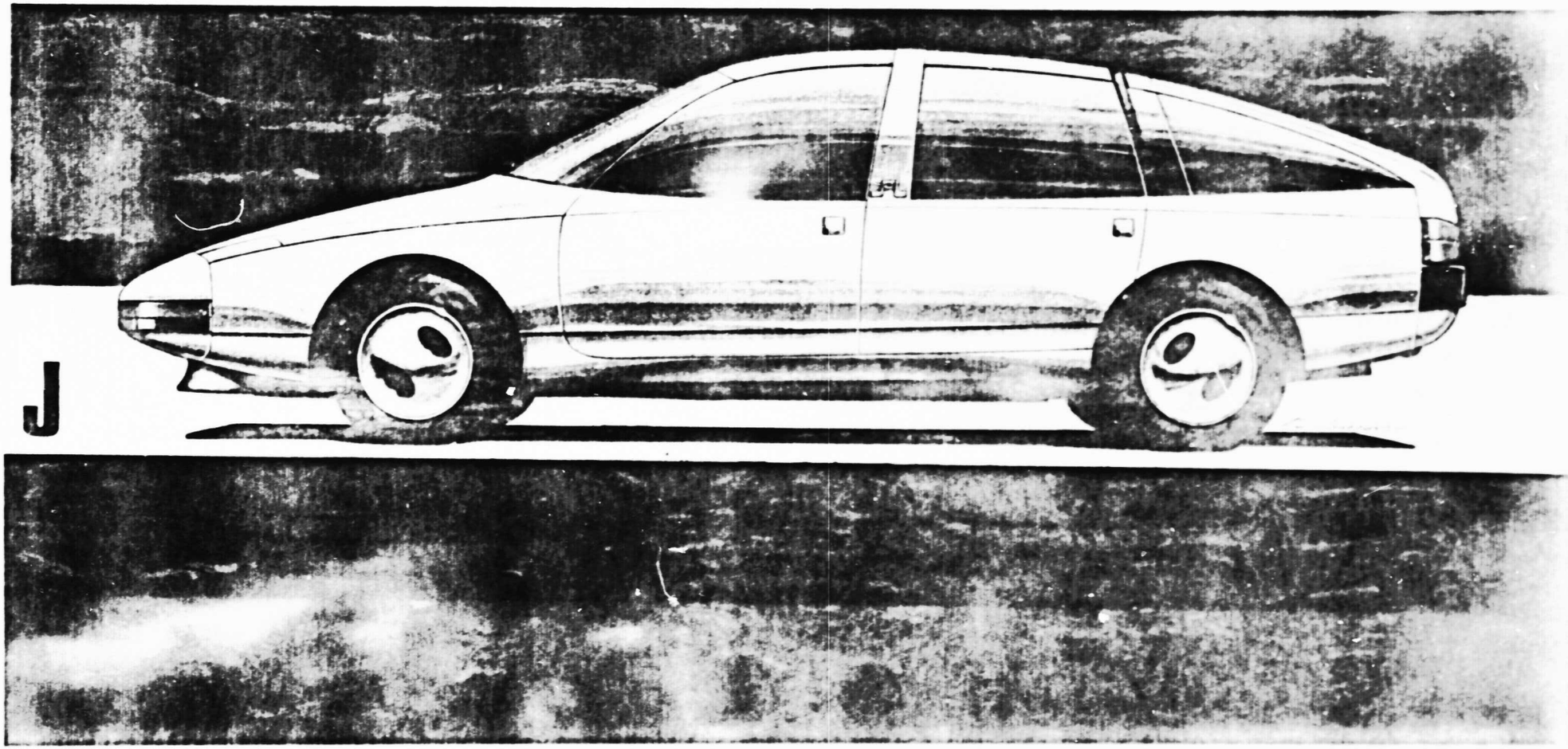


FIG. A.1-3.3 – BODY SHAPE –LATERAL VIEW

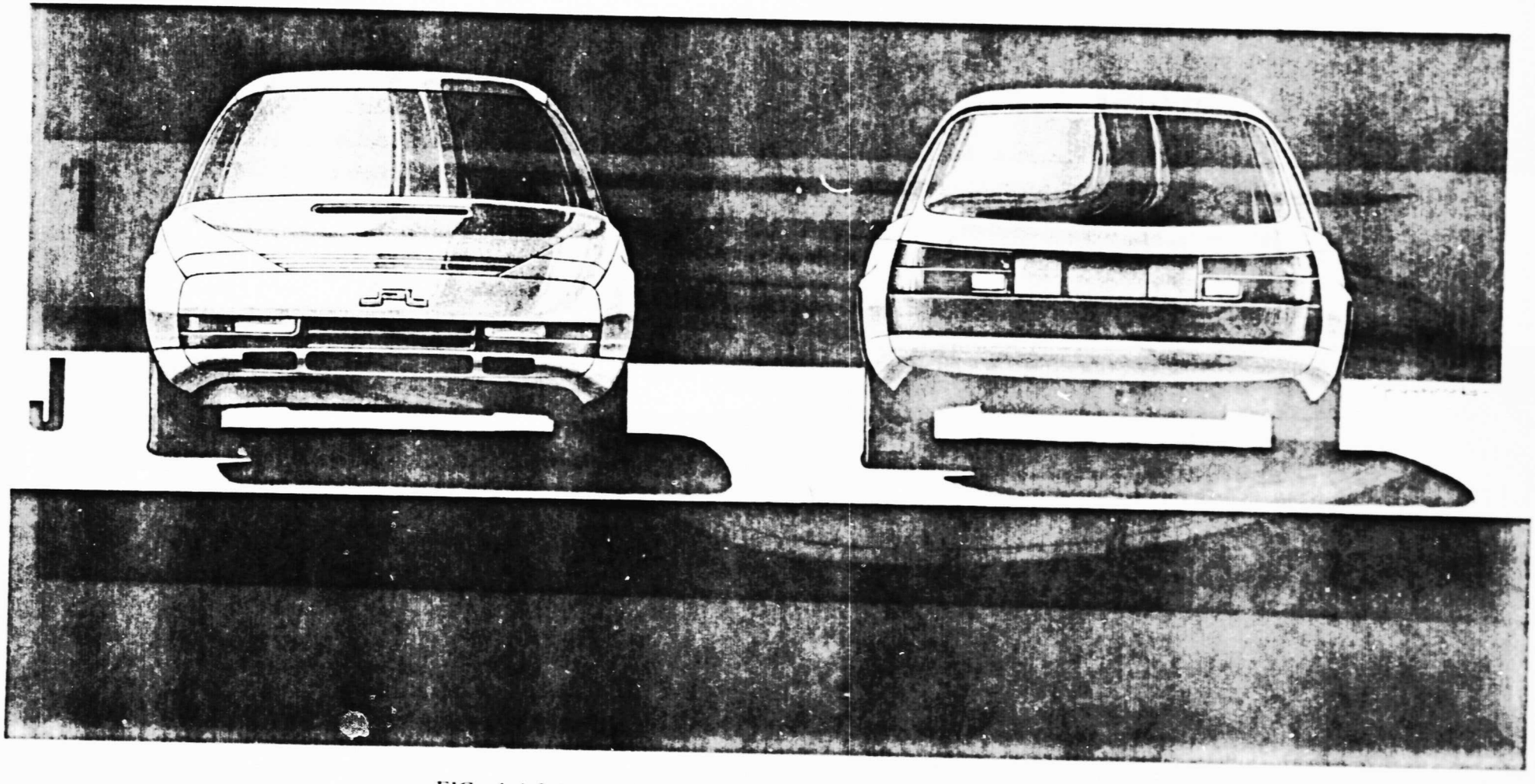


FIG. A.1-3.4 – BODY SHAPE – FRONT AND REAR VIEWS

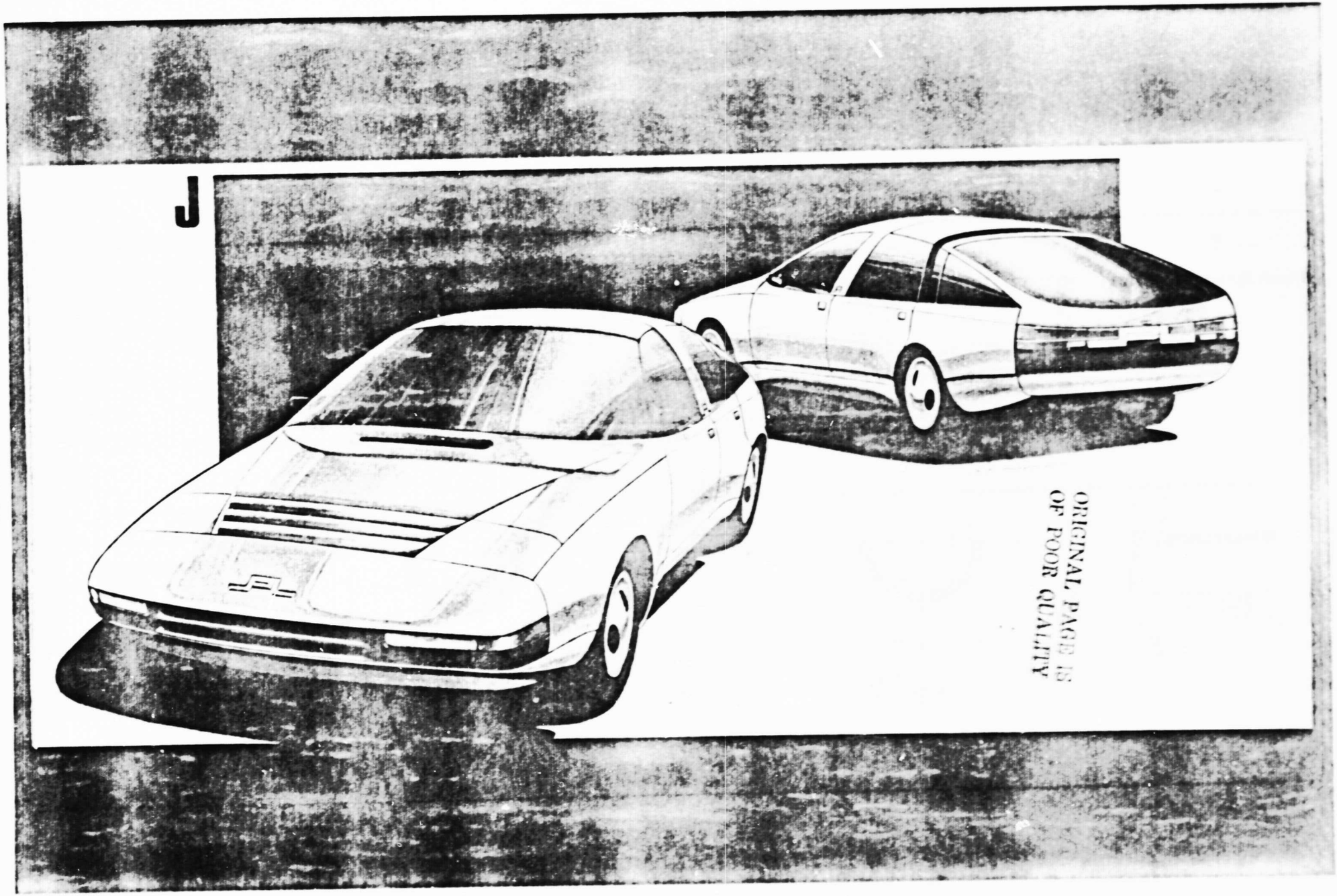


FIG. A.1-3.5 – BODY SHAPE – THREE QUARTER FRONT AND REAR VIEWS

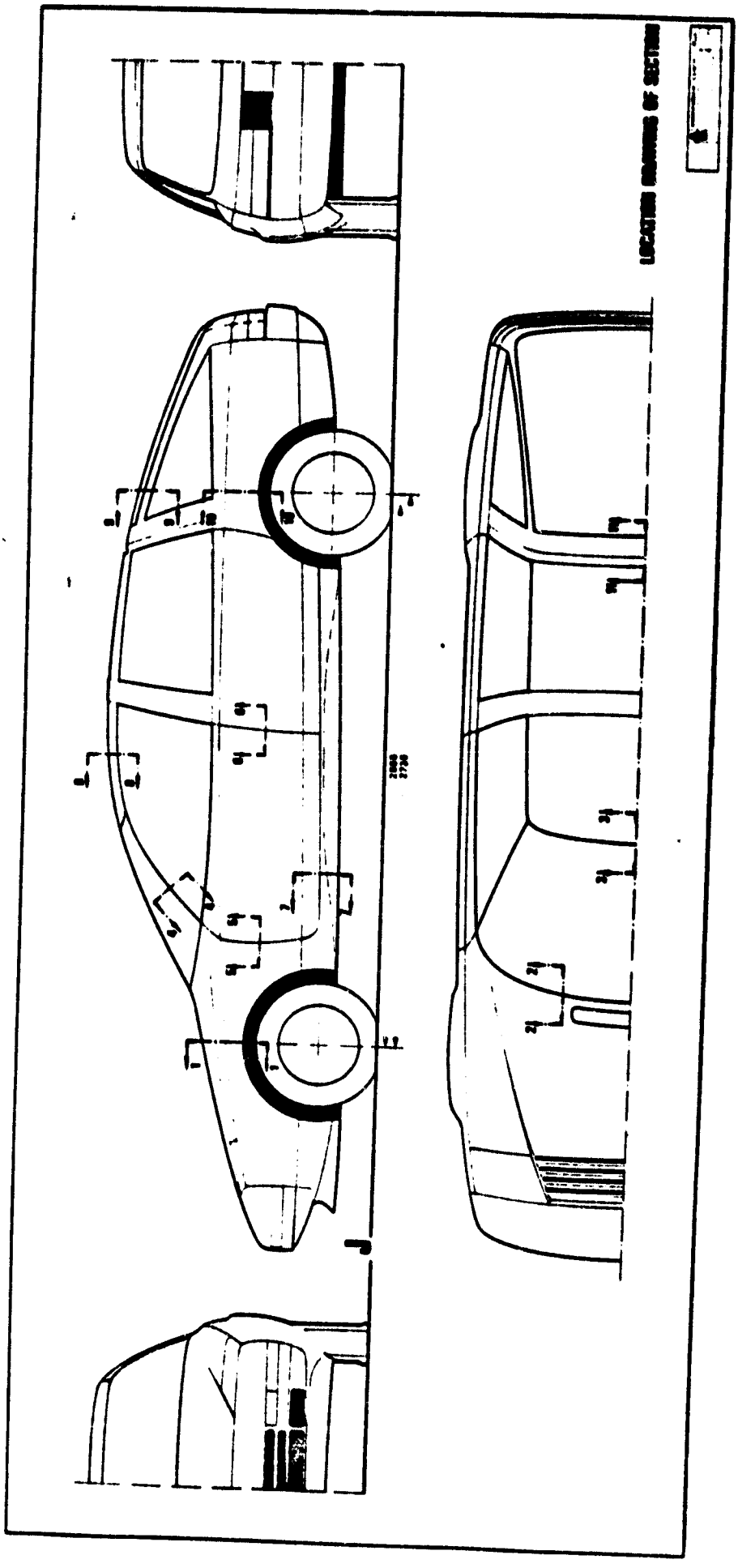


FIG. A.1-3.6 – BODY SHAPE – TYPICAL SECTIONS

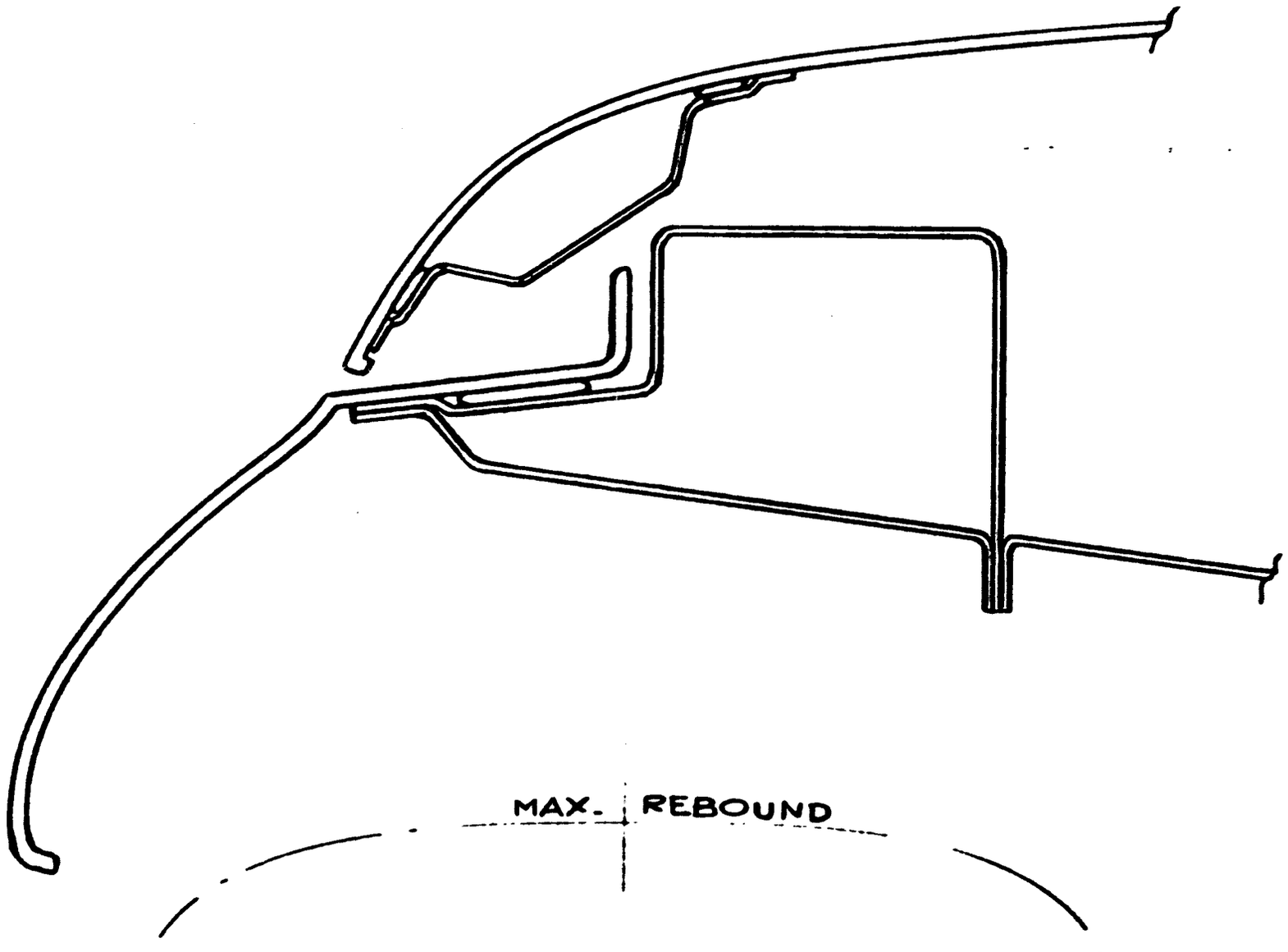


FIG. A.1-3.7 – HOOD/WING SECTION ON FRONT WHEEL CENTER LINE (DISREGARDING SHOCK-ABSORBER)

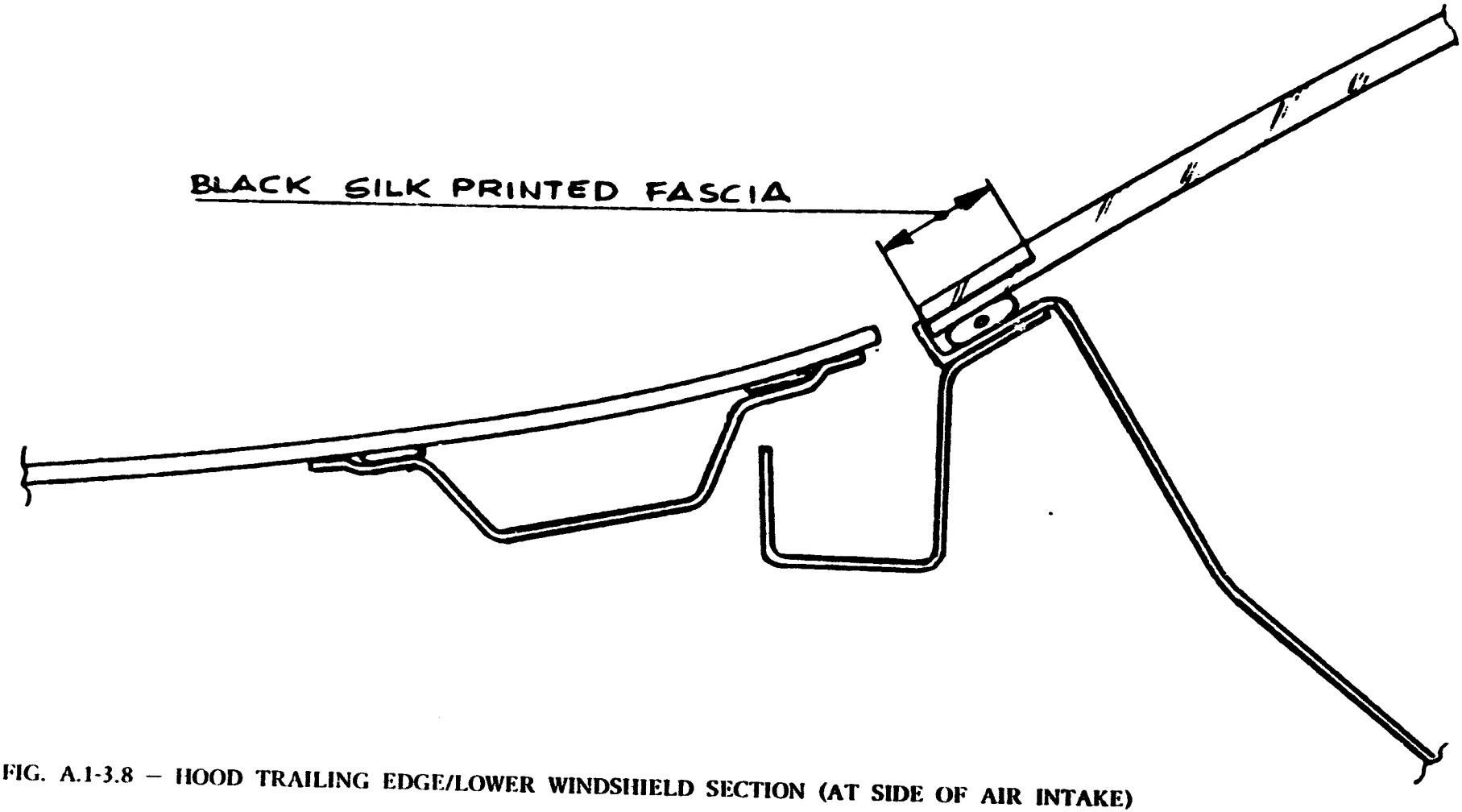


FIG. A.1-3.8 – HOOD TRAILING EDGE/LOWER WINDSHIELD SECTION (AT SIDE OF AIR INTAKE)

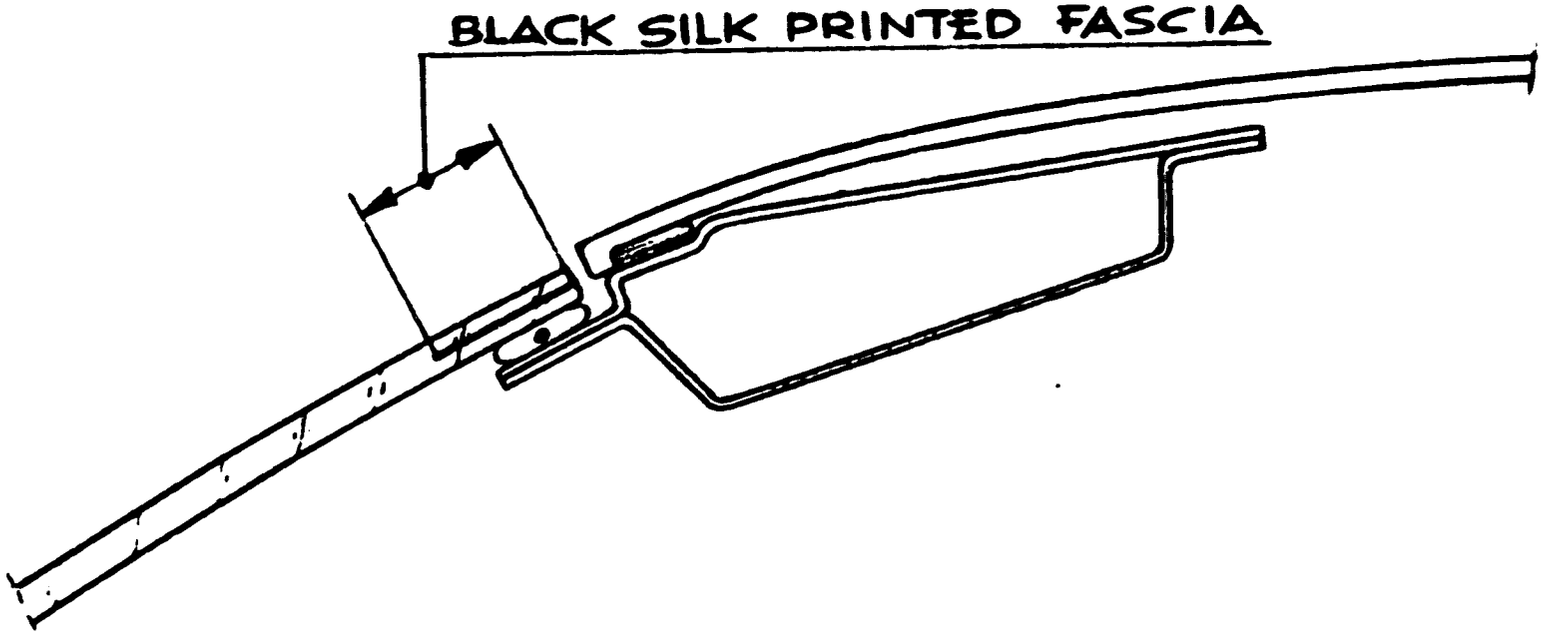


FIG. A.1-3.9 – UPPER WINDSHIELD CENTER SECTION

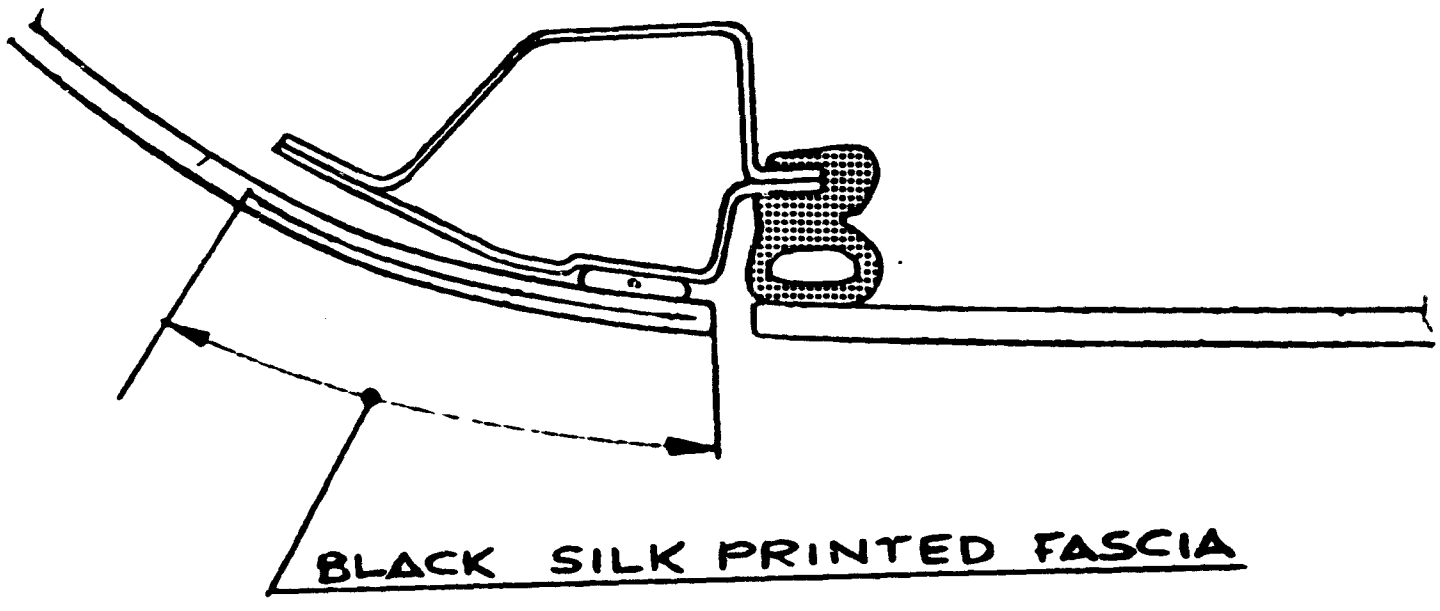


FIG. A.1.-3.10 – "A" PILLAR SECTION

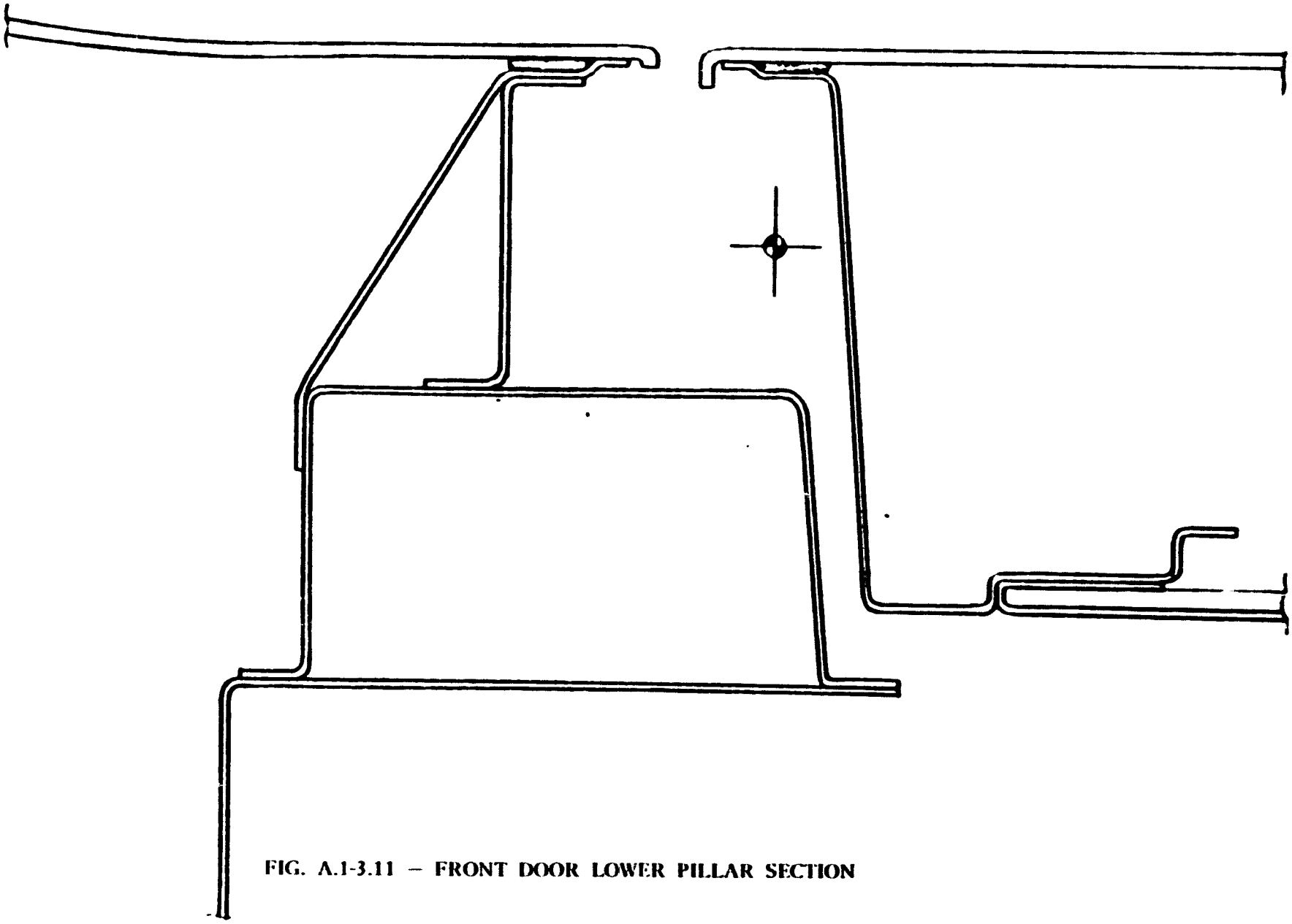


FIG. A.1-3.11 – FRONT DOOR LOWER PILLAR SECTION

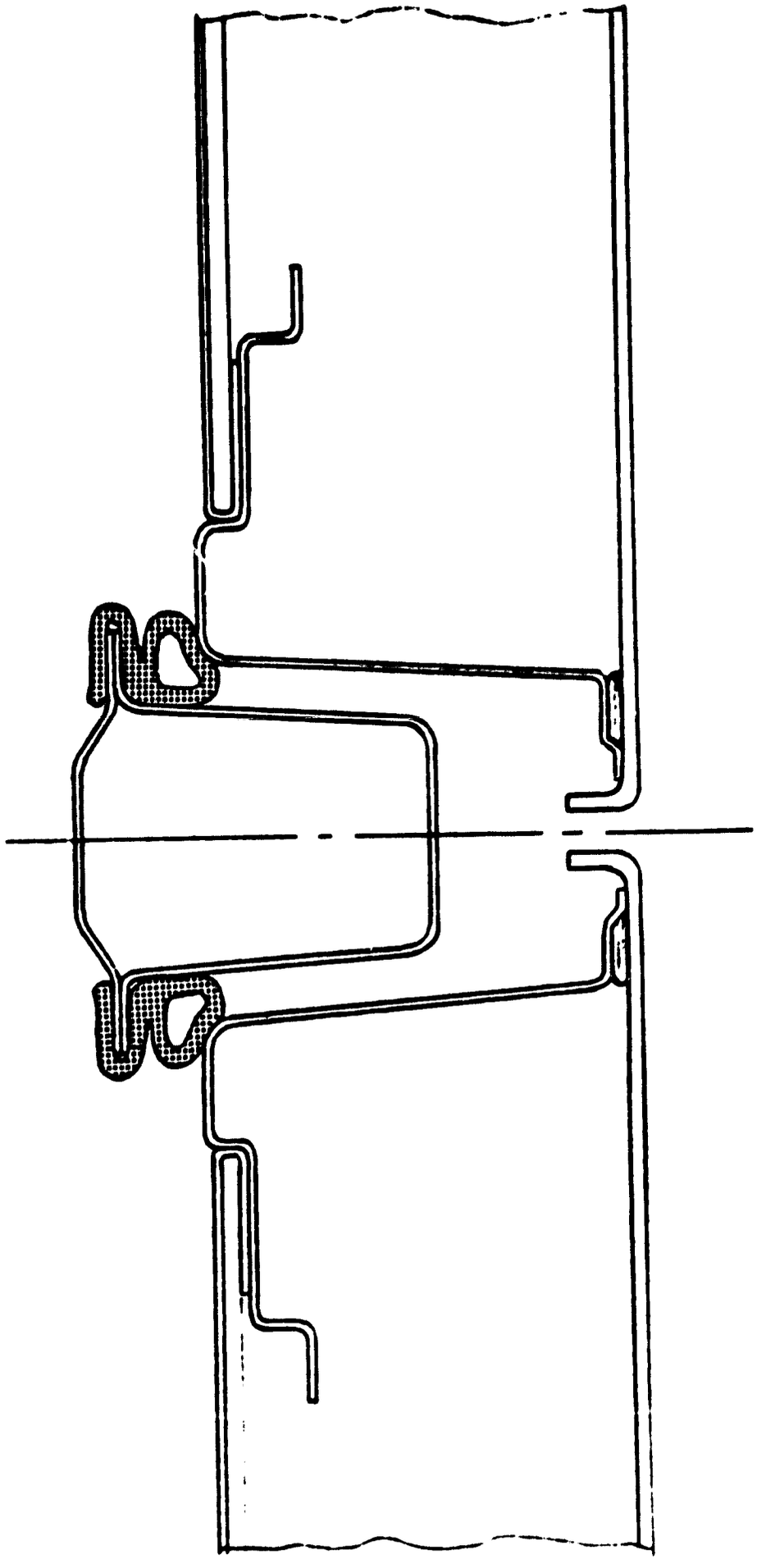


FIG. A.1-3.12 – LOWER CENTER PILLAR SECTION

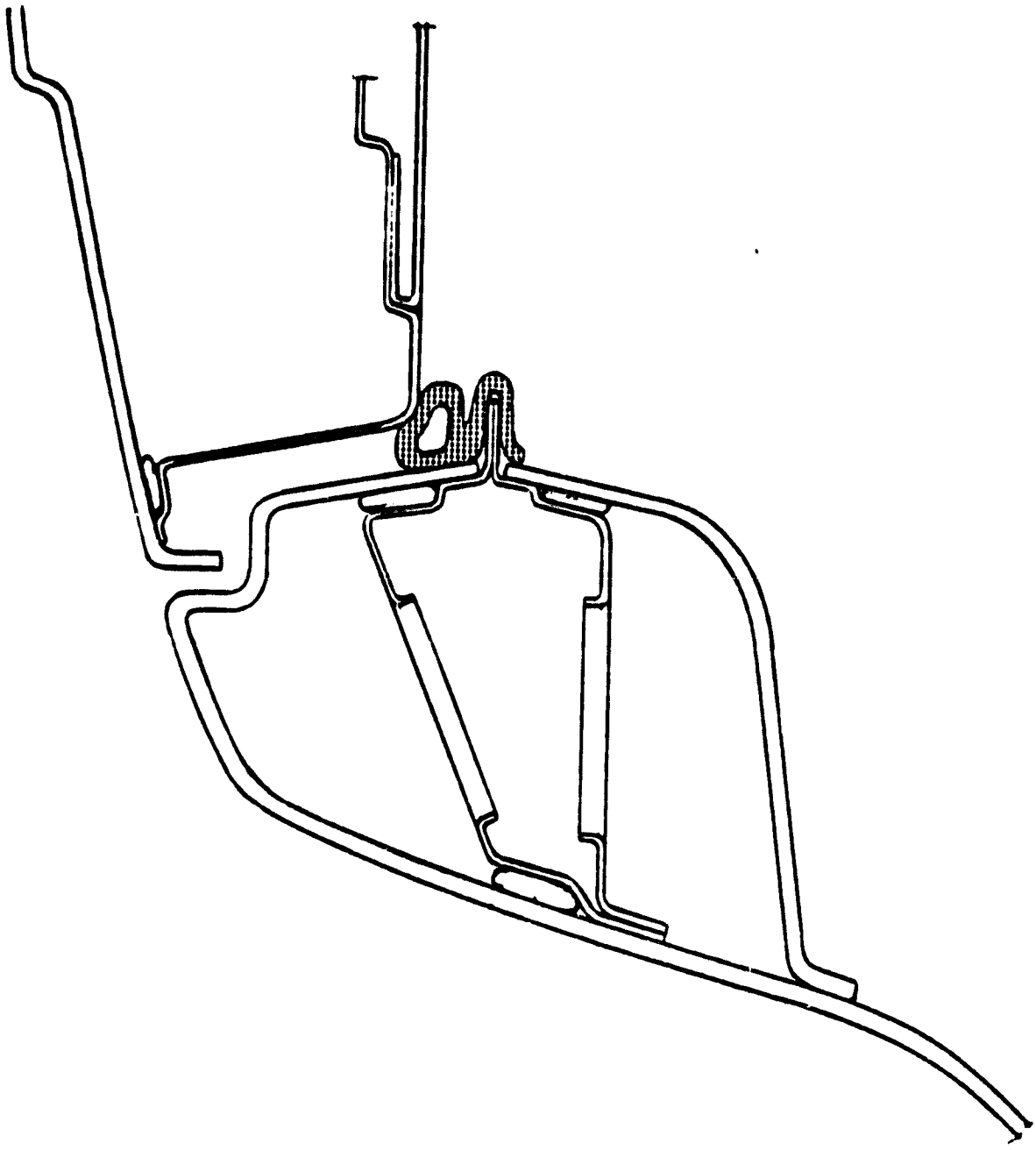


FIG. A.1-3.13 – SILL/ROCKER PANEL & LOWER DOOR EDGE SECTION

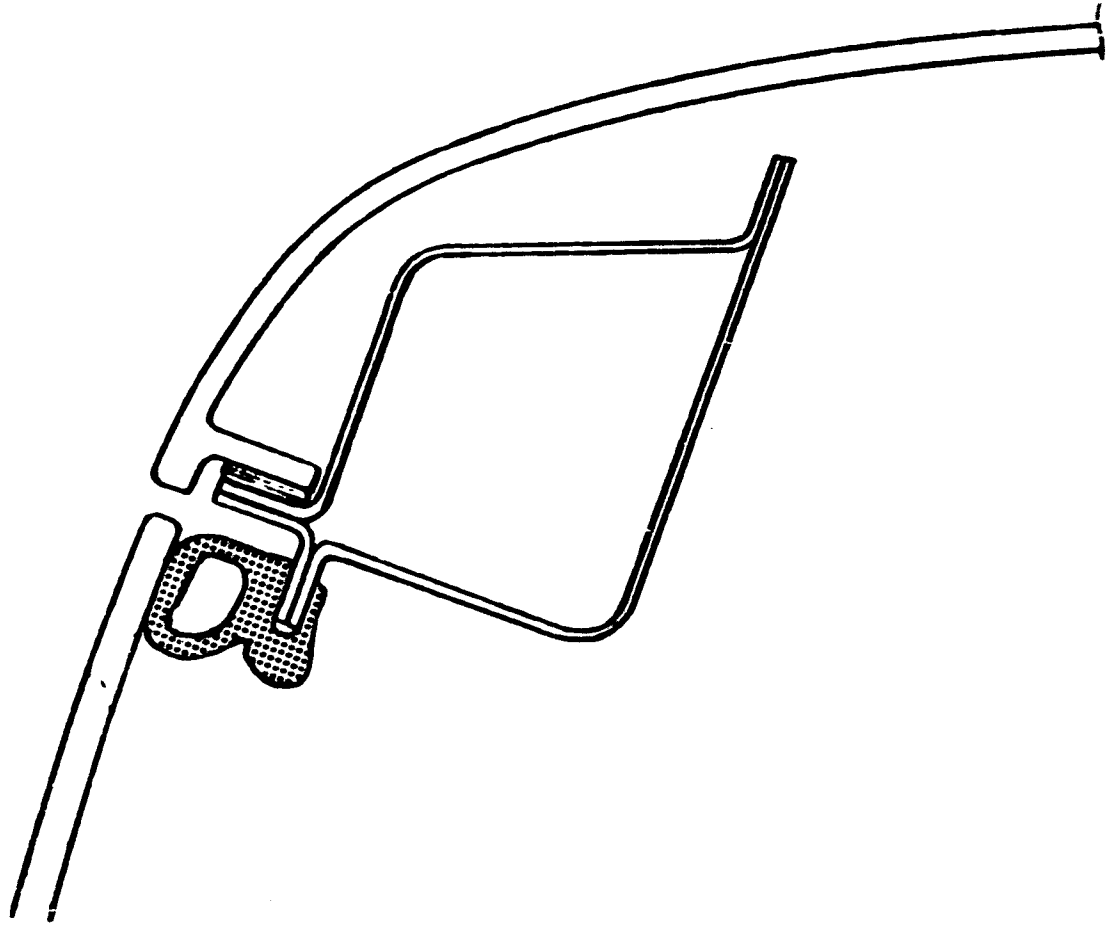


FIG. A.1-3.14 – ROOF/UPPER DOOR EDGE SECTION

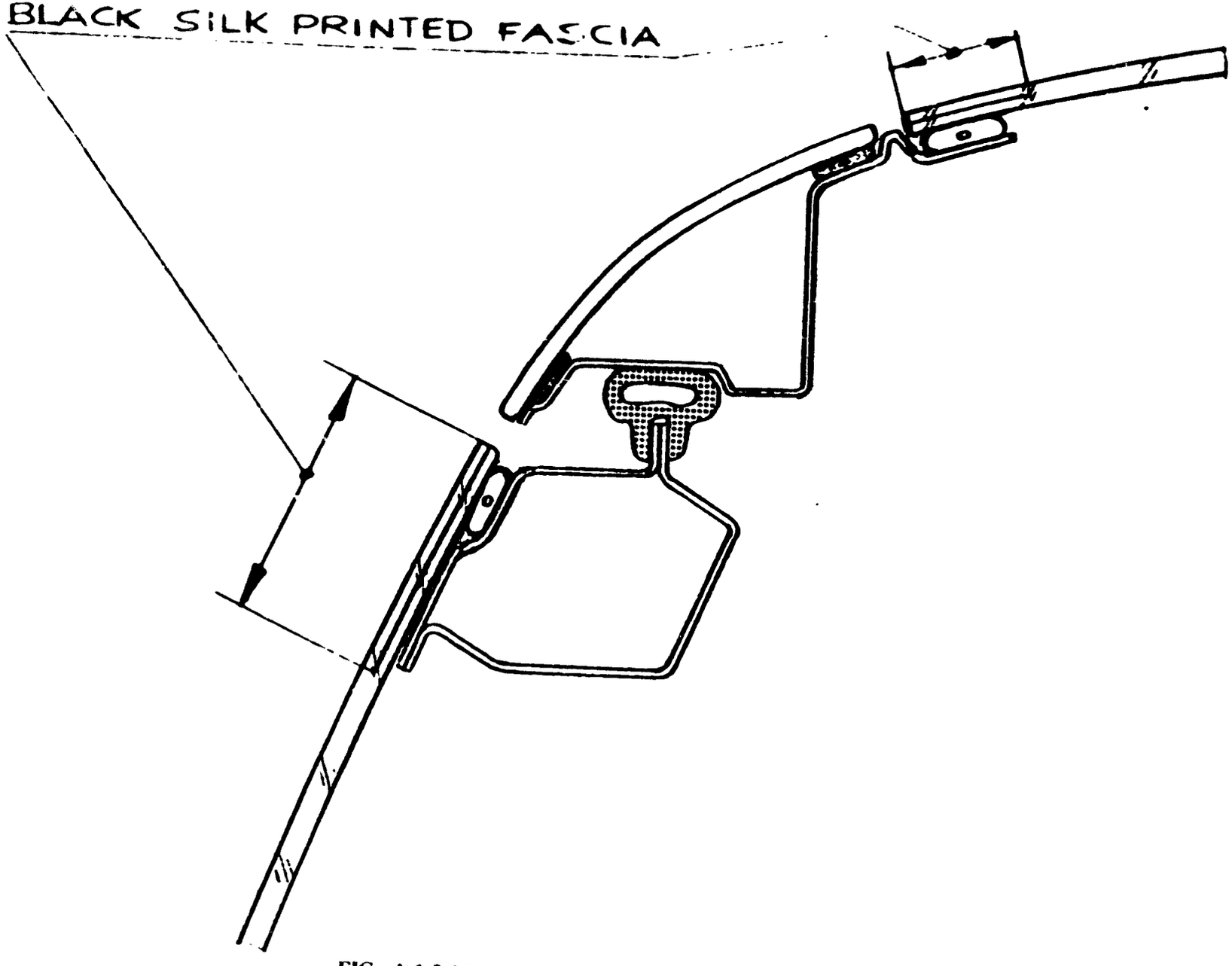


FIG. A.1-3.15 – FIFTH DOOR SIDE SECTION

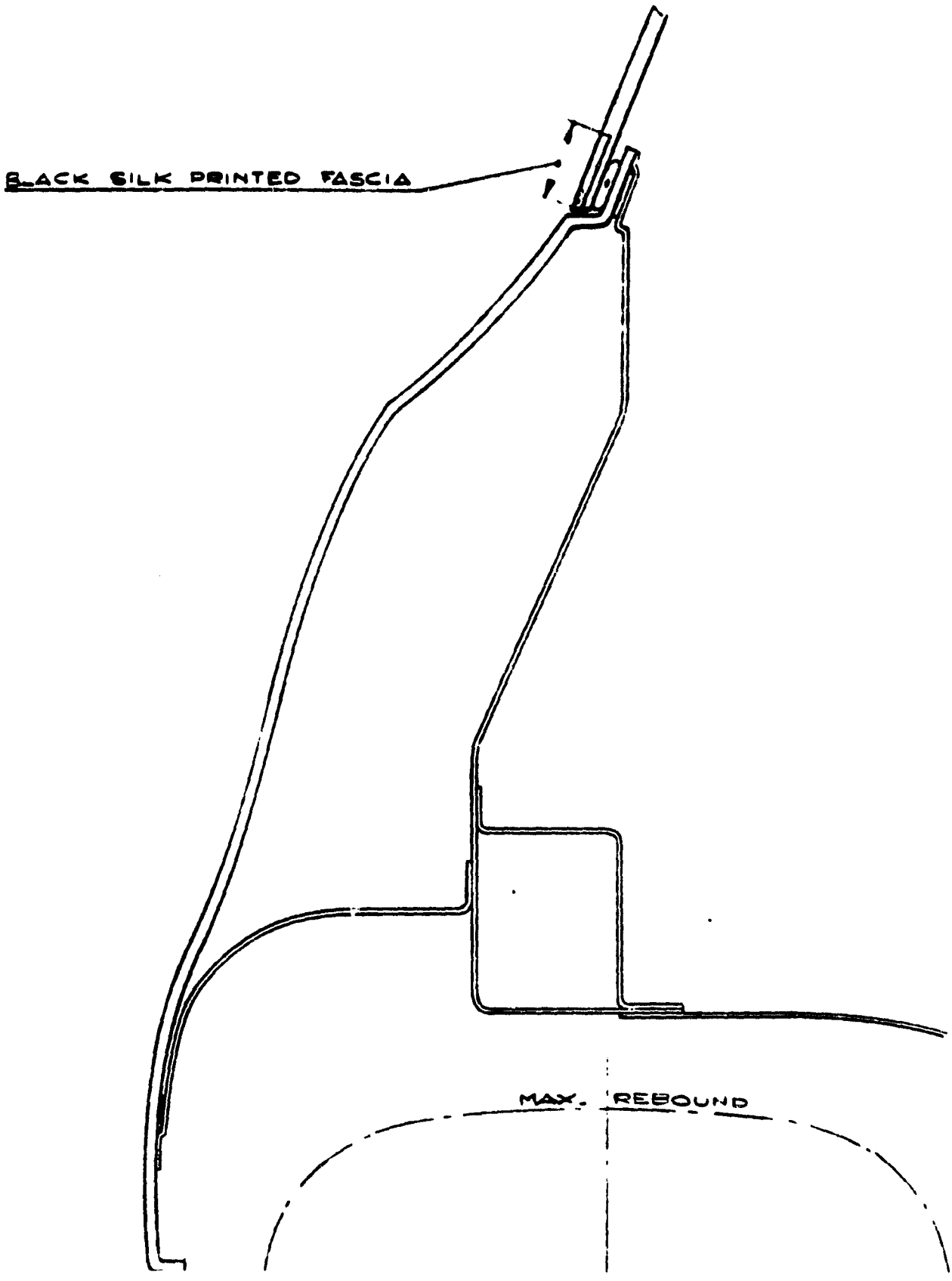


FIG. A.1-3.16 – REAR WING SECTION ON REAR WHEEL CENTER LINE

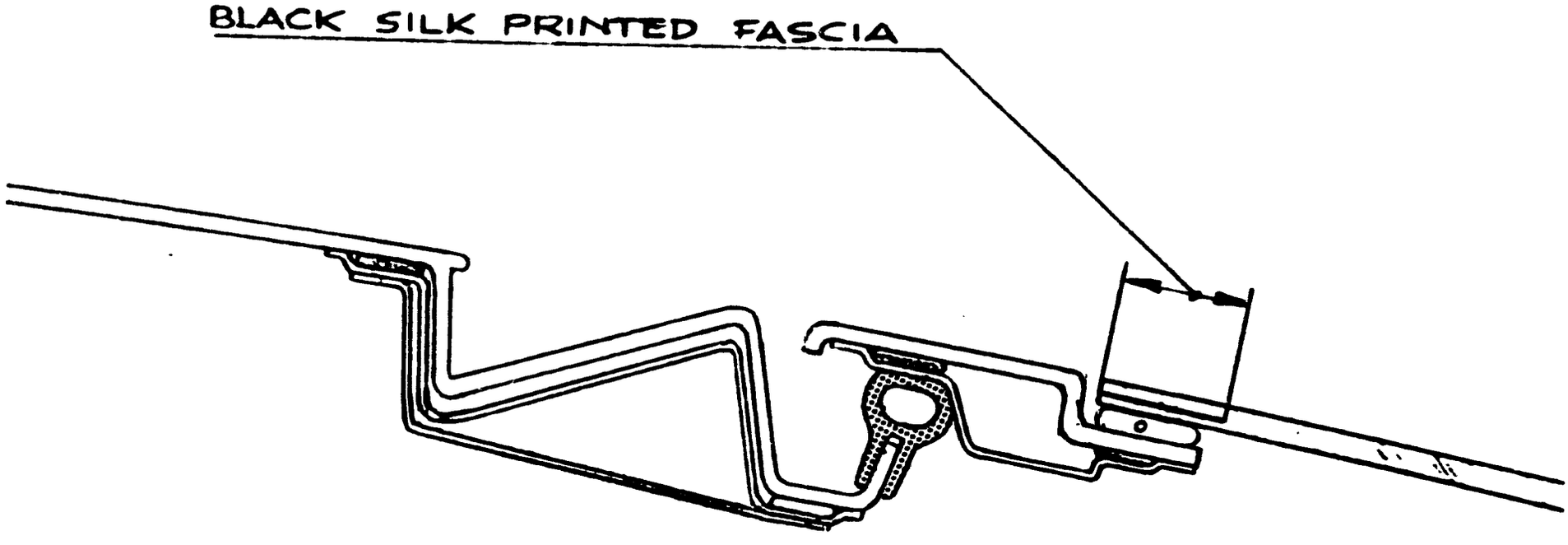


FIG. A.1-3.17 – FIFTH DOOR CENTER SECTION

APPENDIX A.1-4

Final Report No. RT 143 May 24, 1979

SUBCONTRACT PIRELLI - CRF

UNDER JPL CONTRACT No. 955187

"NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM"
PHASE I

Projected characteristics of tires to be produced according to the state of the art technology of the '80 s and particularly suitable for Internal Combustion Engine vehicles and for the "Hybrid Vehicle"

1. INTRODUCTION

A preliminary evaluation of the characteristics of the tires that will be produced in accordance with the state of the art technology of the '80s can be made taking account of the tire evolution trend in these last decades and also of:

1) the technological innovation that takes advantage of the new developments in terms of materials and techniques
2) the vehicle evolution
3) the market trend evolution.

This trend can be extrapolated for the next 5-10 years, bearing in mind that points 2) and 3) will play a greater role than in the past in relation to the problems of energy cost increase.

As far as vehicles are concerned, i.e. the internal combustion engine type and the hybrid type, reference is made to vehicles capable of reaching a maximum speed of 130 km/h and the design of which aims at a drastic reduction in consumptions; it is assumed, also, that in both cases all the other performance characteristics are comparable (accelerations, comfort etc.).

In particular the hybrid vehicle proposed by FIAT will have the following characteristics:

Curb weight	1600 kg
Capacity (5 persons + baggage)	420 kg
Total weight	2020 kg

The following have been assumed as reference characteristics for the tires used on such vehicles:

Vertical stiffness
Cornering stiffness
Road holding on wet surface
Rolling resistance

The above characteristics do not include parameters which are directly connected to tire safety, although this must be perfectly adequate for all the vehicle working conditions.

2. TIRES FOR INTERNAL COMBUSTION ENGINE VEHICLE

2.1 Vertical Stiffness

This is a very important parameter because, together with suspension stiffness, it contributes considerably to the ride smoothness and comfort.

What is actually of interest under this point of view is the dynamic vertical stiffness measured while the tire is rolling, in the area of deflection corresponding to load conditions.

The only important improvement, as far as this parameter is concerned (in the elapse of time that has been considered) has been in passing from bias-ply tires to radial-ply tires (see Fig. A.1-4.1)).

For radial-ply tires, further considerable changes in this parameter are not expected in the future. Anyway an increase in tire pressure results in an energy absorption reduction (Fig. A.1-4.2)) and, therefore, the increase in vertical stiffness which follows will be relevant for obtaining a saving in energy, expecially if it is accompanied by appropriate modifications to the vehicle suspension system.

2.2 Cornering Stiffness

The cornering stiffness is a parameter that has kept growing as a function of the tire structrure (bias-ply tire, radial-ply tire, etc.). The present trend towards low profile radial-ply tires would have the potential capability of providing a higher value of cornering stiffness; on the other hand, while it is rather doubtful that a further increase of this parameter would result in an appreciable driveability advantage, the strucures necessary to achieve this might result in a higher rolling resistance coefficient.

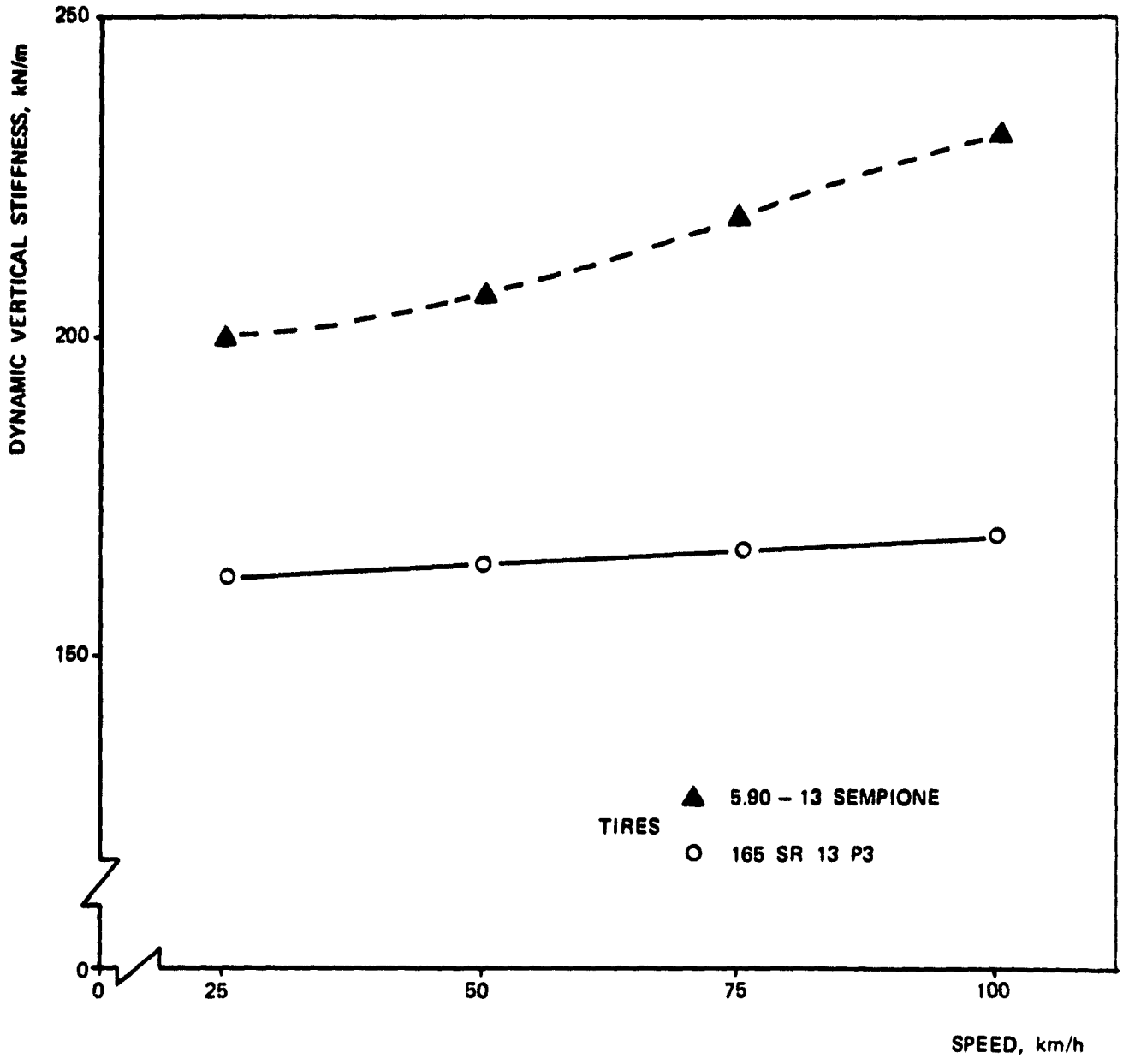


FIG. A.1-4.1– DYNAMIC VERTICAL STIFFNESS VS SPEED FOR TWO DIFFERENT TIRES

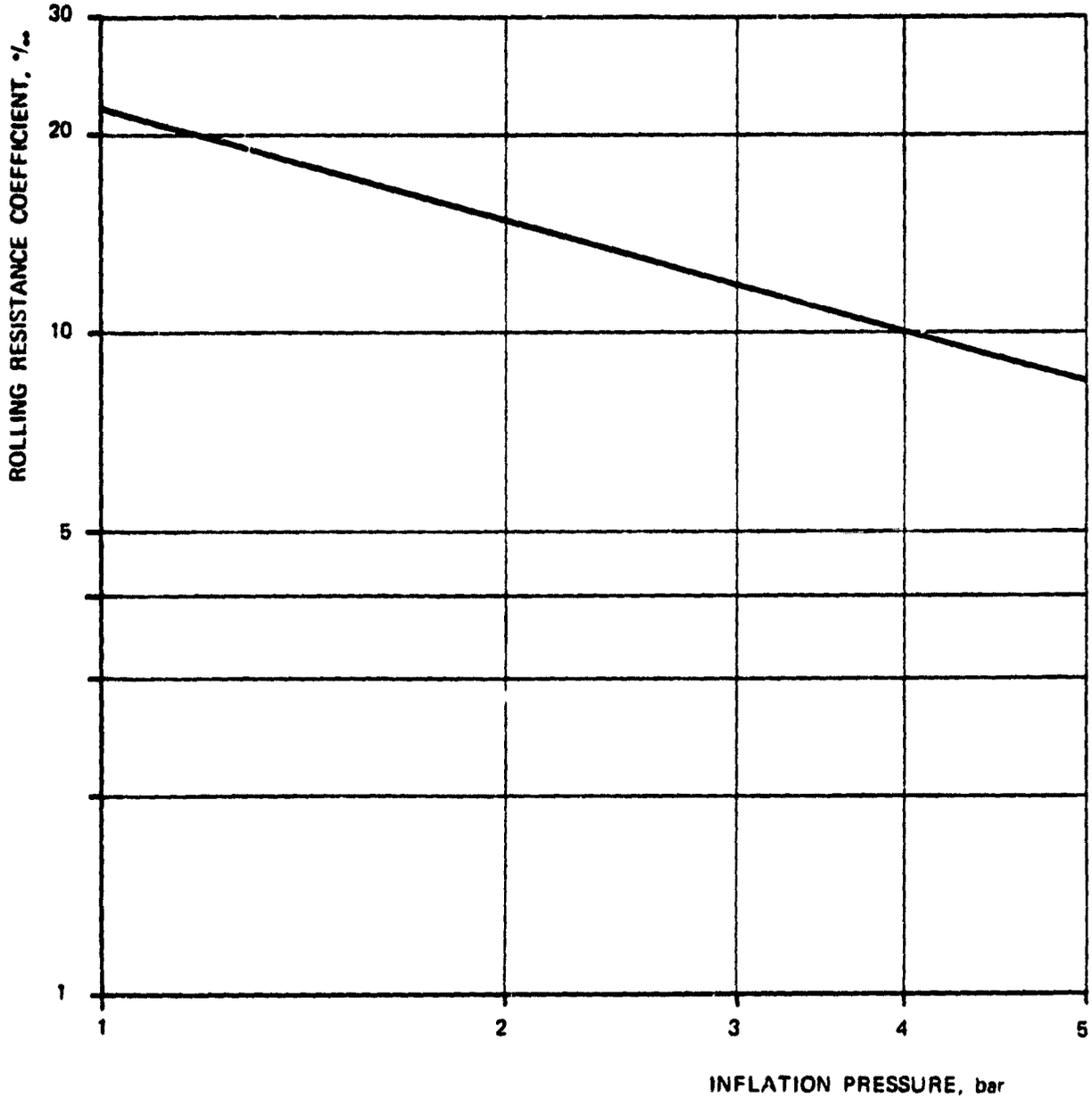


FIG. A.1-4.2 – INFLATION PRESSURE EFFECT ON ROLLING RESISTANCE COEFFICIENT

Based upon these considerations, a value of tire height/width ratio has been taken as reference which is between 0.70 and 0.60, so that a cornering stiffness can be assumed which maintains the present values (Fig. A.1-4.3).

2.3 Roadholding on wet surface

Although it is rather hard to evaluate this parameter quantitatively, it can be stated that the use of radial-ply tires has improved the vehicle roadholding on wet surface for the fact that for this type of tire it is possible to adopt highly grooved treads.

Another relevant improvement has been in passing from quasi longitudinal grooved treads to transverse treads.

This is particularly important at high speeds, when the loss of traction due to aquaplaning effects becomes relevant.

It is expected that roadholding on wet surfaces at low speeds (in which the tread compound becomes important) will be maintained at its present values, that can be considered acceptable, also in order not to compromise the rolling resistance values which would become higher in case higher traction coefficient compounds are adopted.

Roadholding on wet surfaces at high speeds will instead improve, independently from the rolling resistance coefficient, by properly modifying the tread design.

This forecast, which is bound to such an important factor like safety, remains valid also if the actual speed of vehicles will diminish both for power reduction reasons (due to fuel saving) and for reduction of the speed limits.

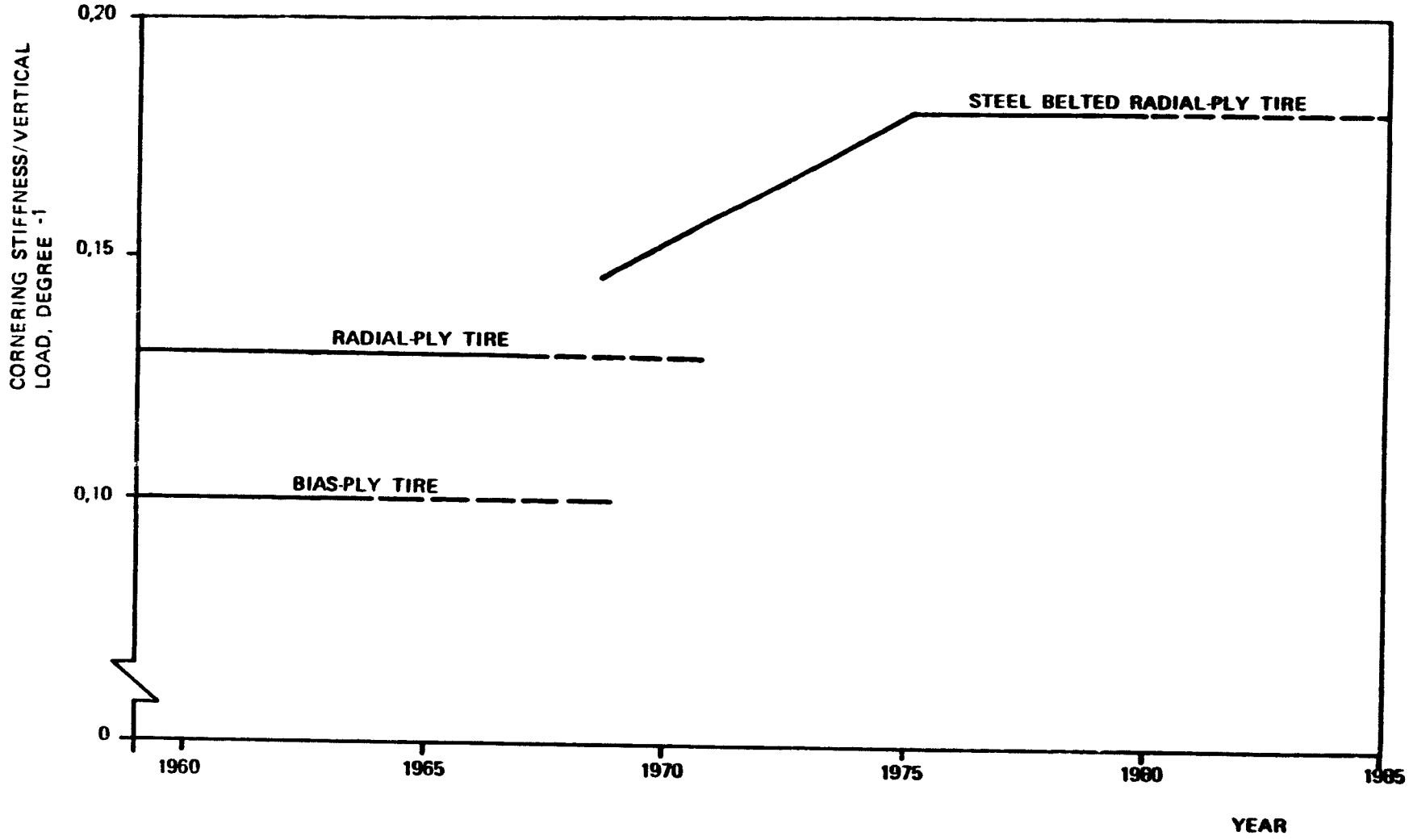


FIG. A.1-4.3 TIME EVOLUTION OF CORNERING STIFFNESS/VERTICAL LOAD RATIO FOR DIFFERENT TIRE TYPE

2.4 Tire dimensions

The tire across dimensions will slightly increase, external diameter and deflection being equal, in view of the introduction of the low profile type tires: this type of tires presents in fact low energy absorption characteristics that are obtainable without sacrificing other properties.

The use of tires of a diameter slightly greater than the present one (cross section and deflection being equal) might imply a further decrease of the rolling resistance coefficient (Fig. A.1-4.4).

It can be assumed, without involving big changes in the vehicle architecture, that appropriately designed cars capable of very low fuel consumption, will be equipped with tires with diameters 10% greater than the present ones.

2.5 Rolling resistance

Also in this case the tire technological evolution has led to an appreciable improvement in terms of rolling resistance (Fig. A.1-4.5).

It can be expected that the values presently reached will further diminish for tires of the 80's, due to improvements that can be obtained on the tire itself and to the adoption of slightly larger diameters (+10%).

3. TIRES FOR HYBRID VEHICLE

The specific characteristics of the tires for the hybrid vehicle will not be substantially different (excluding dimensions which are function of the various loads per axle) from those of the internal combustion engine vehicle (refer to paragraph 1 for reference vehicle characteristics).

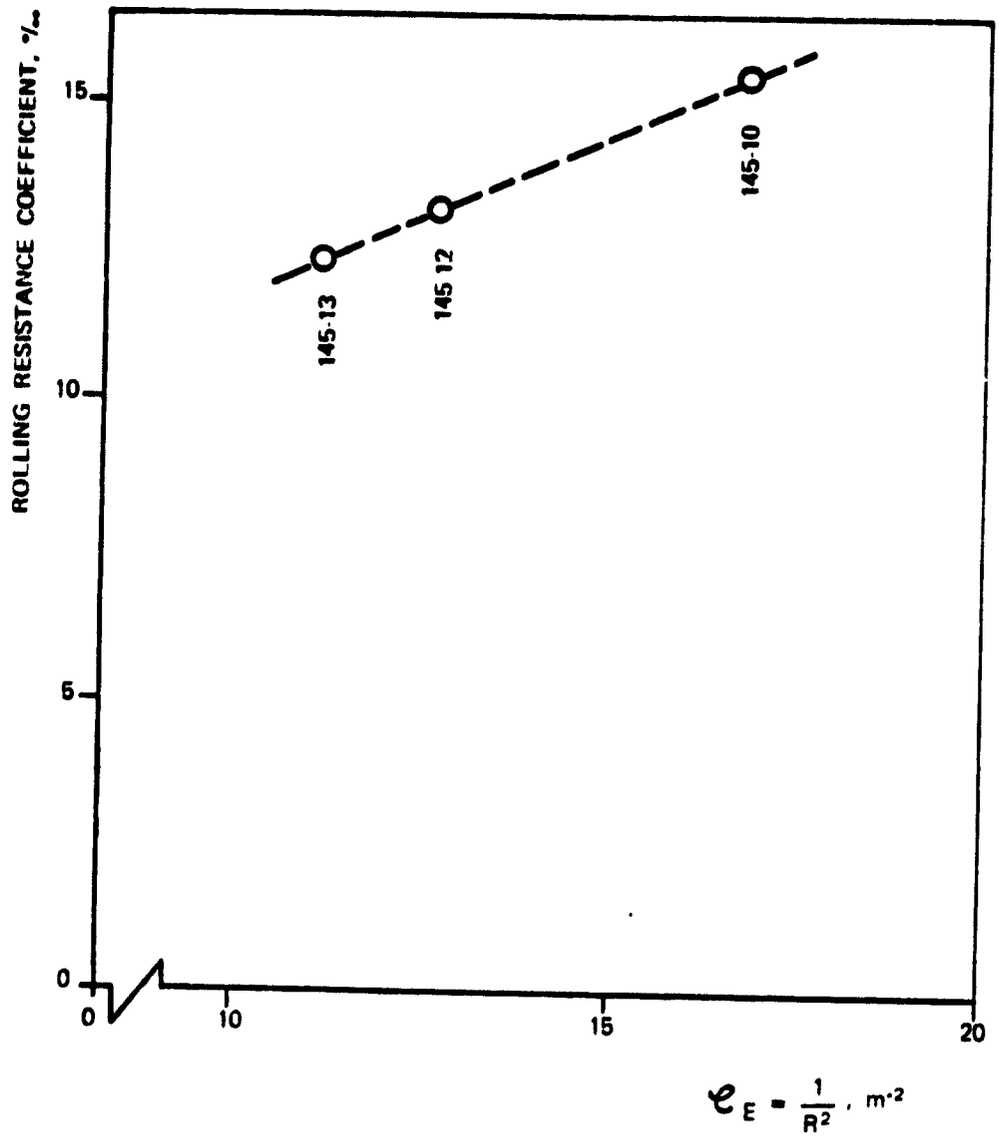


FIG. A.1-4.4 – TIRE RADIUS EFFECT ON ROLLING RESISTANCE COEFFICIENT

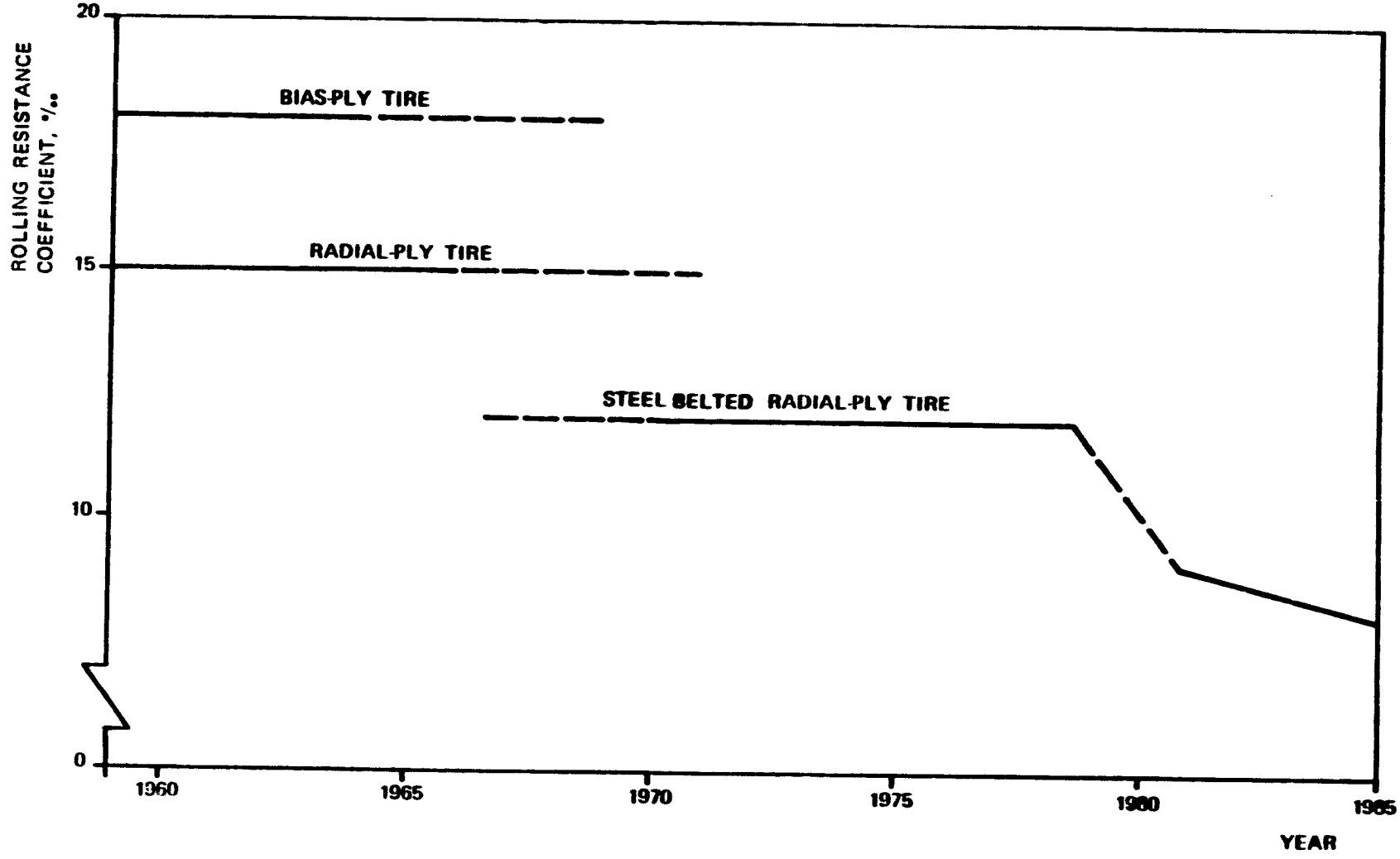


FIG. A.1-4.5- ROLLING RESISTANCE COEFFICIENT VS YEAR AS A FUNCTION OF PLY TIRE TYPE

However the greater overall weight of the hybrid vehicle and, most of all, the smaller ratio between full load weight and weight with driver only, allow, with the same level of comfort, to use a higher inflation pressure. Assuming a 20% increase in inflation pressure, the rolling resistance that can be expected for hybrid vehicle tires will further decrease (Fig. A.1-4.6).

4. COST ESTIMATES

The tires under consideration will have substantially the same weight as the present ones; the use of high-quality materials capable of reducing the rolling resistance will imply a cost increase not greater than 5%.

5. PIRELLI POSSIBLE CONTRIBUTION TO PHASE II OF THE PROGRAM

Pirelli possible contribution to Phase II of the program will consist in supplying prototype tires especially designed and manufactured for the hybrid vehicle.

6. CONCLUSIONS

The state of the art technology of the '80s will result in a large scale production of radial-ply tires and particularly in a broad use of the low profile type tires.

In general, there will be an improvement in tire characteristics due to the inevitable perfectioning of the product, but the preliminary parameters (vertical and cornering stiffness) will maintain their present values. An exception is

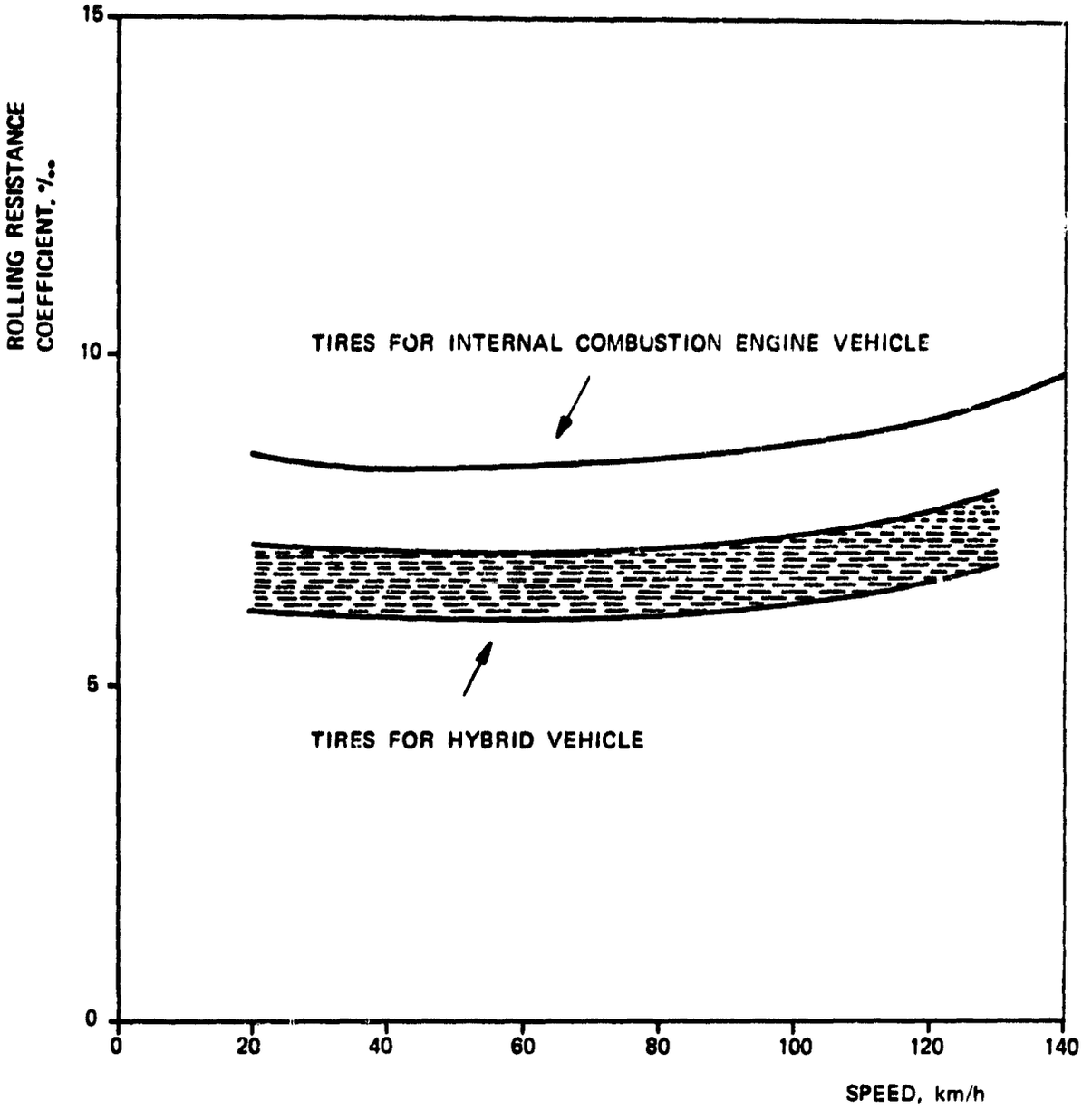


FIG. A.1-4.6 – ROLLING RESISTANCE COEFFICIENT VS SPEED FOR DIFFERENT VEHICLES

represented by the rolling resistance coefficient which, owing to the adoption of slightly larger diameters, will reduce down to a value of 0.8%.

For the hybrid vehicle, because of the greater masses involved and of smaller load variations, it will be possible to adopt higher inflation pressures, so as to reduce the rolling resistance coefficient down to about 0.6%-0.7%.

The overall dimensions will be according to the FIAT proposed limits

Ø = 650 mm

Chord = 195 mm

The expected cornering stiffness characteristics are given in Fig. A.1-4.7.

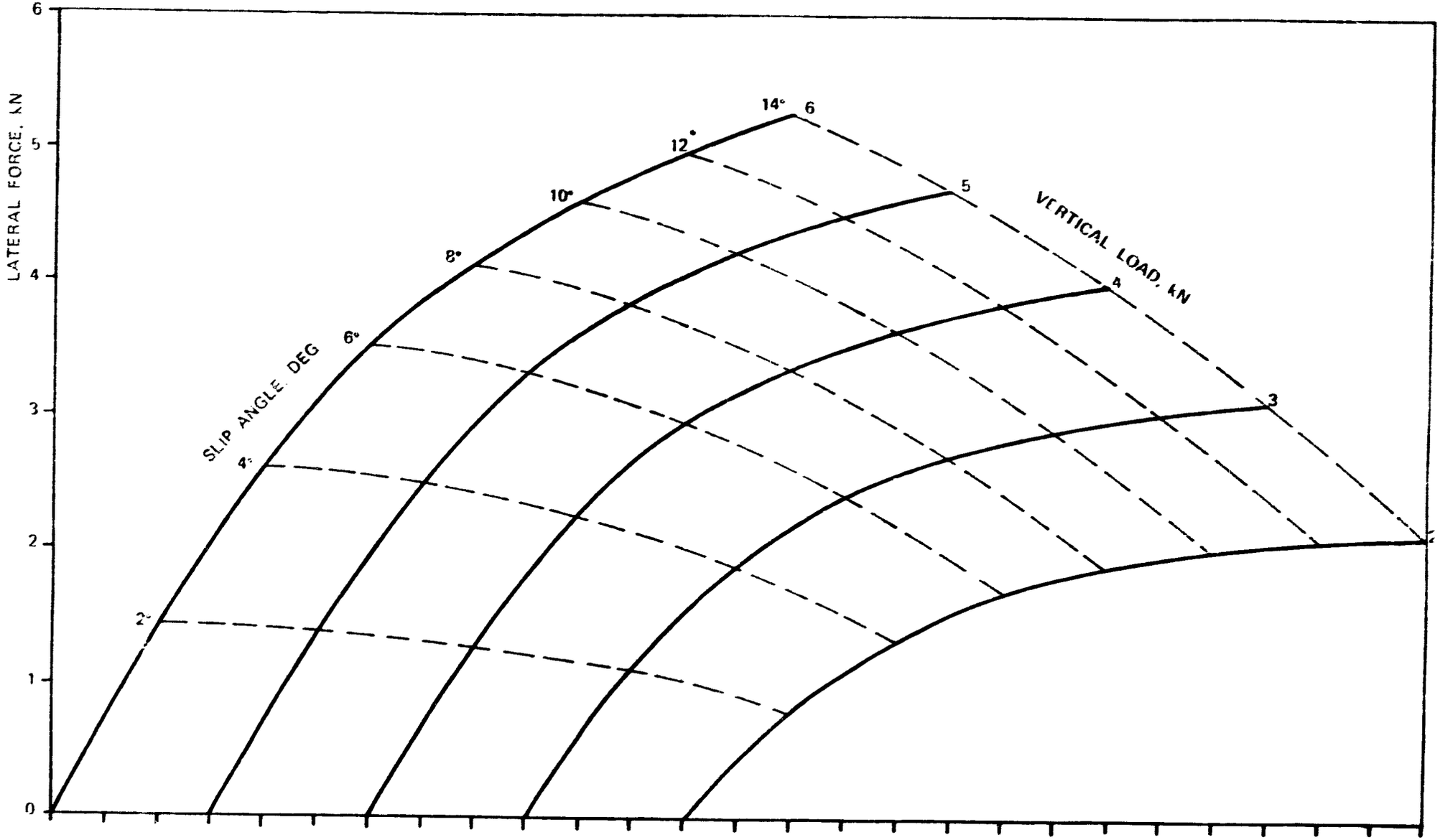


FIG. A.1-4-7 CORNERING STIFFNESS CHARACTERISTICS FOR HYBRID VEHICLE TIRES

APPENDIX A.3-1

HANDLING COMPUTER SIMULATION MODEL

The mathematical model is characterized by 11 d.o.f. (degrees of freedom) so distribuited:

- 6 d.o.f. associated with the body, considered like a rigid body in which the overall sprung mass is included. They are the 3 body center-of-gravity translations and the 3 body rotations (roll, pitch, yaw)
- 4 d.o.f. associated with the angular velocity of each wheel since different slip ratios are possible
- 1 d.o.f. associated with the steering wheel angle. This degree of freedom exists only for those maneuvers in which the steering wheel is released.

The main input data required by the program are the following:

- vehicle geometry
- sprung and unsprung mass
- moments of inertia
- geometric, kinematic and elastic characteristics of the suspensions
- braking system characteristics
- steering system characteristics
- transmission characteristics (gear, final ratio, torque converter,...)
- tires characteristics
- propulsion system characteristics
- aerodynamic parameters
- maneuver data.

In the frame of the main characteristics, the simulation mathematical model:

- performs a simulation of a vehicle (not necessary having a symmetrical behaviour) with any of the four wheels being either driving or braking or both
- takes into account the non-linearity of the suspension and

estimates its longitudinal and lateral displacements

- can deal both with indipendent suspensions and rigid axles; therefore it takes into account effects due to possible anti-pitch and/or anti-roll rods
- as far as tire are concerned, considers the non-linear relationship between lateral forces and slip angles, normal load and tractive forces. Moreover it estimates camber forces and aligning torques. Vertical and lateral tire flexibilities are instead neglected
- assumes that the central moments of inertia of the vehicle remains constant during any motion: the interaction of those parts that change position during the maneuver is therefore neglected
- takes automatically into account the aerodynamic effects due to the vehicle speed
- can introduce external disturbances such as wind gusts from any direction and external forces and/or torques applied to the center of gravity
- neglects any effect connected with an irregular road-bed or the lifting of a wheel from the ground.

The model can simulate all the "open-loop" tests (free path). Among these:

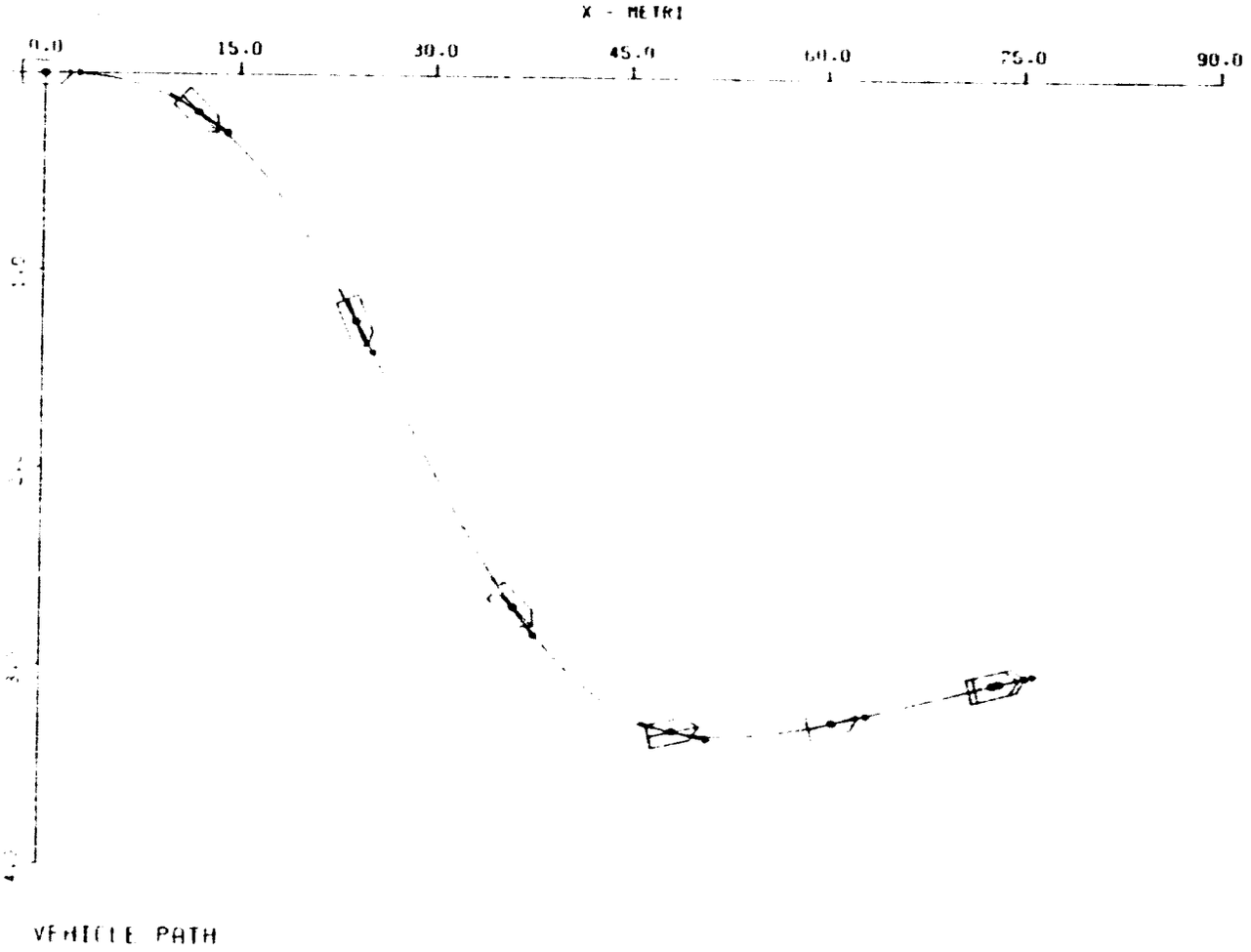
- steering-pad
- steering wheel angle input
- throttle release
- balanced or unbalanced braking during straight forward or cornering motion
- external disturbances
- overtaking (only if steering wheel angle recording is available).

The characteristic outputs of the program are shown in the following pages. Graphs and Tables are relative to one of the maneuvers performed in the frame of hybrid-reference vehicle behaviour comparison.

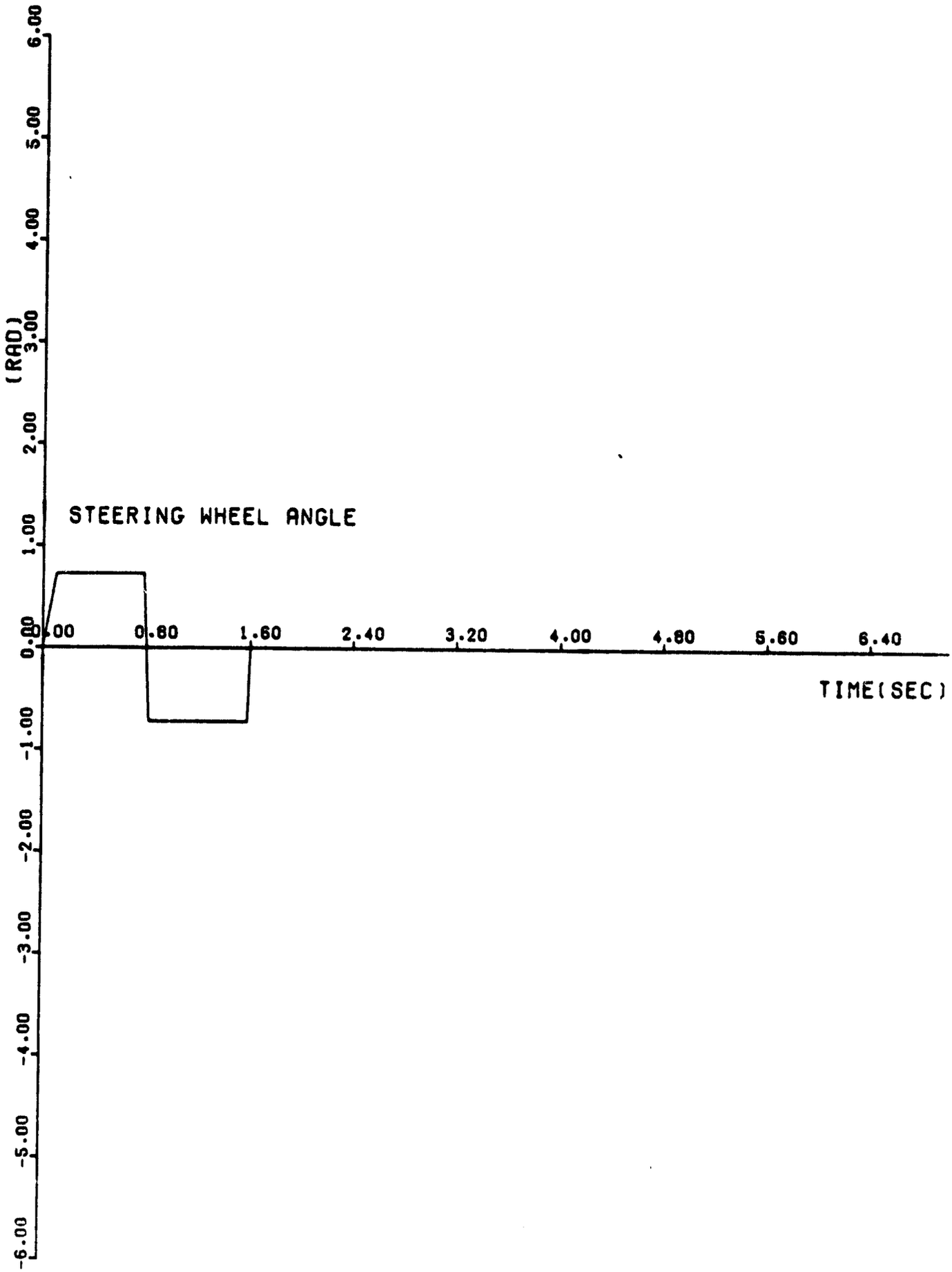
GRAPHS

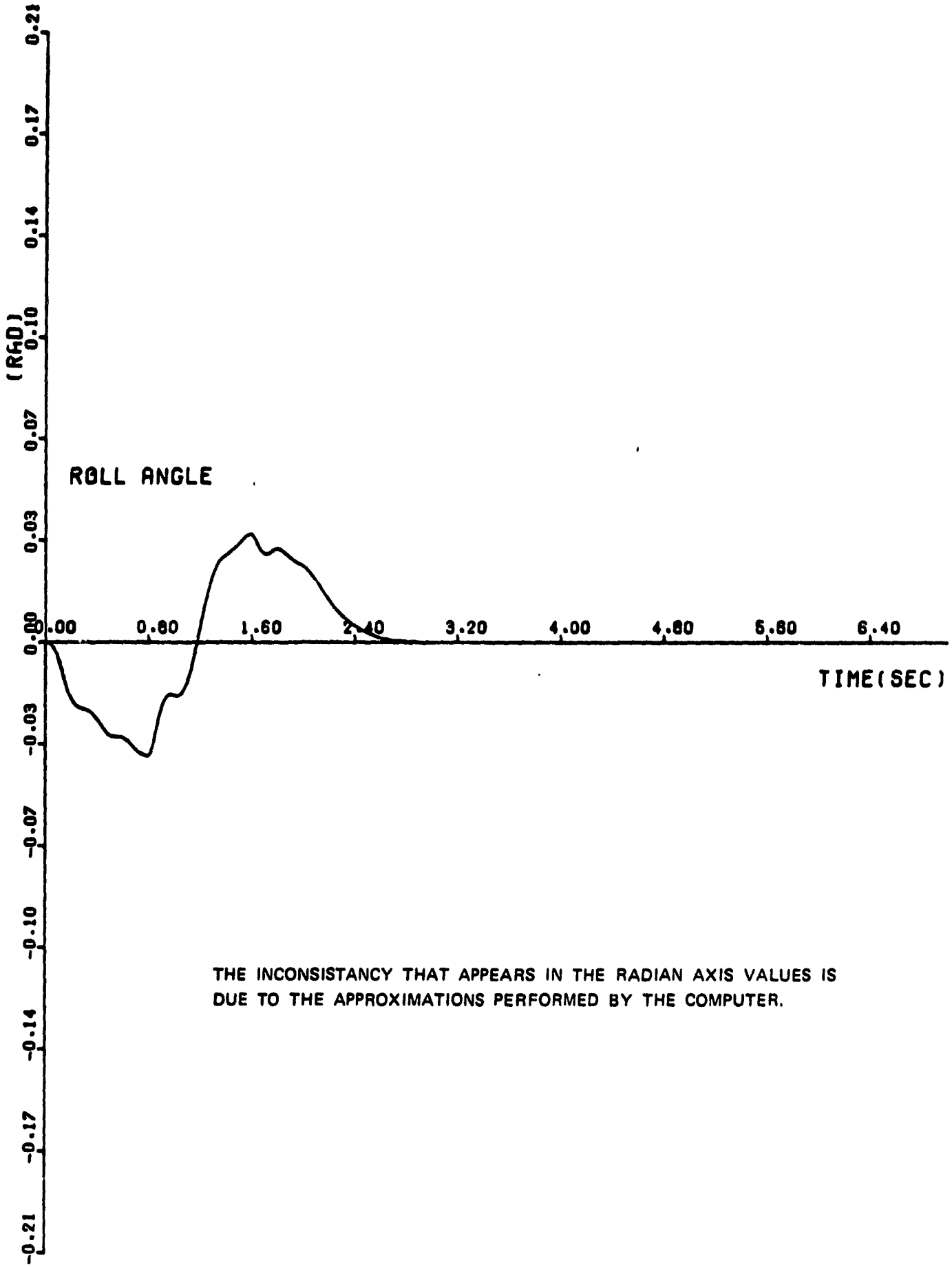
TABLES

** HANDLING **

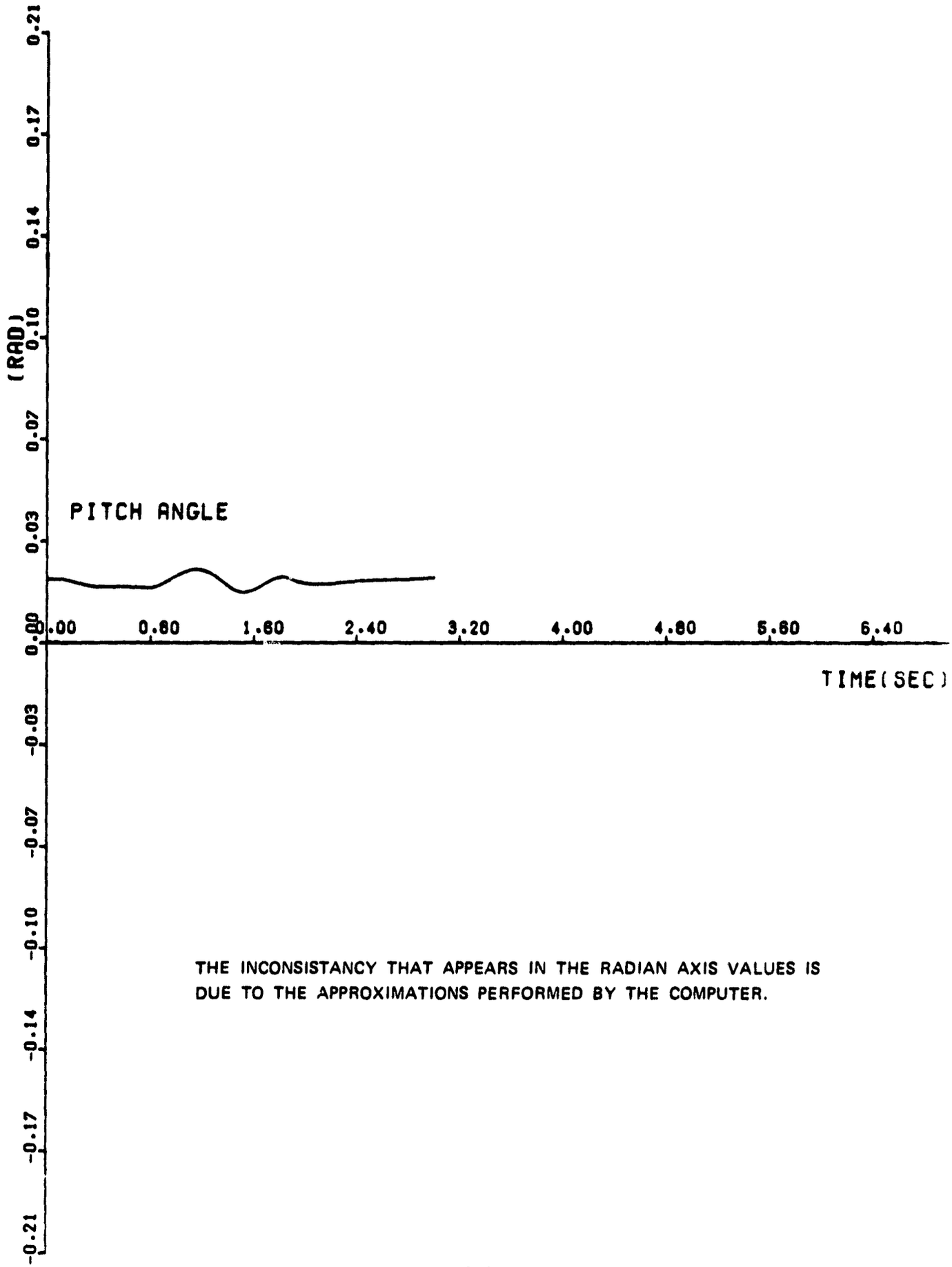


VEHICLE PATH

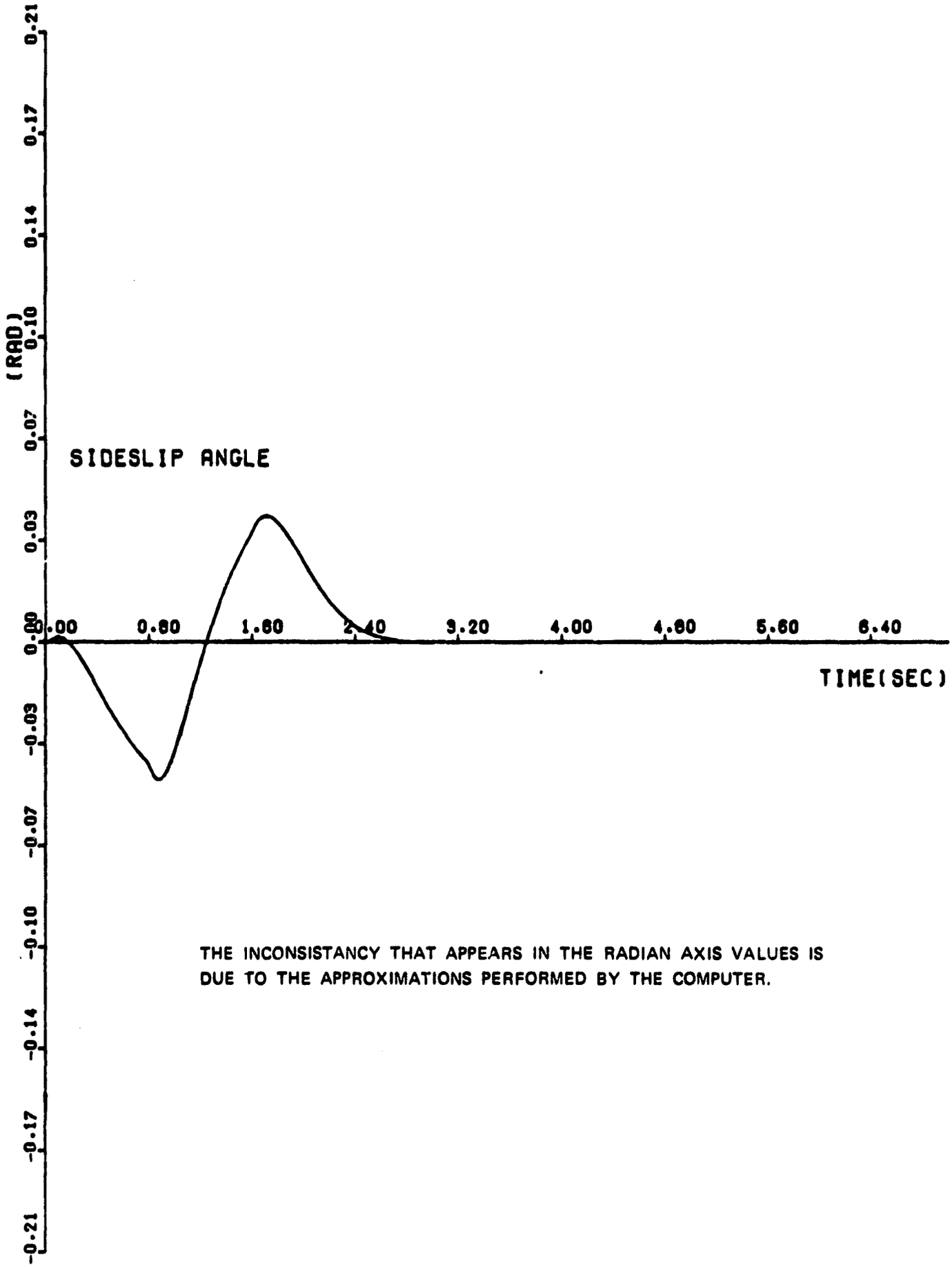

STEERING WHEEL ANGLE
(RAD)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
0.00
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
TIME(SEC)



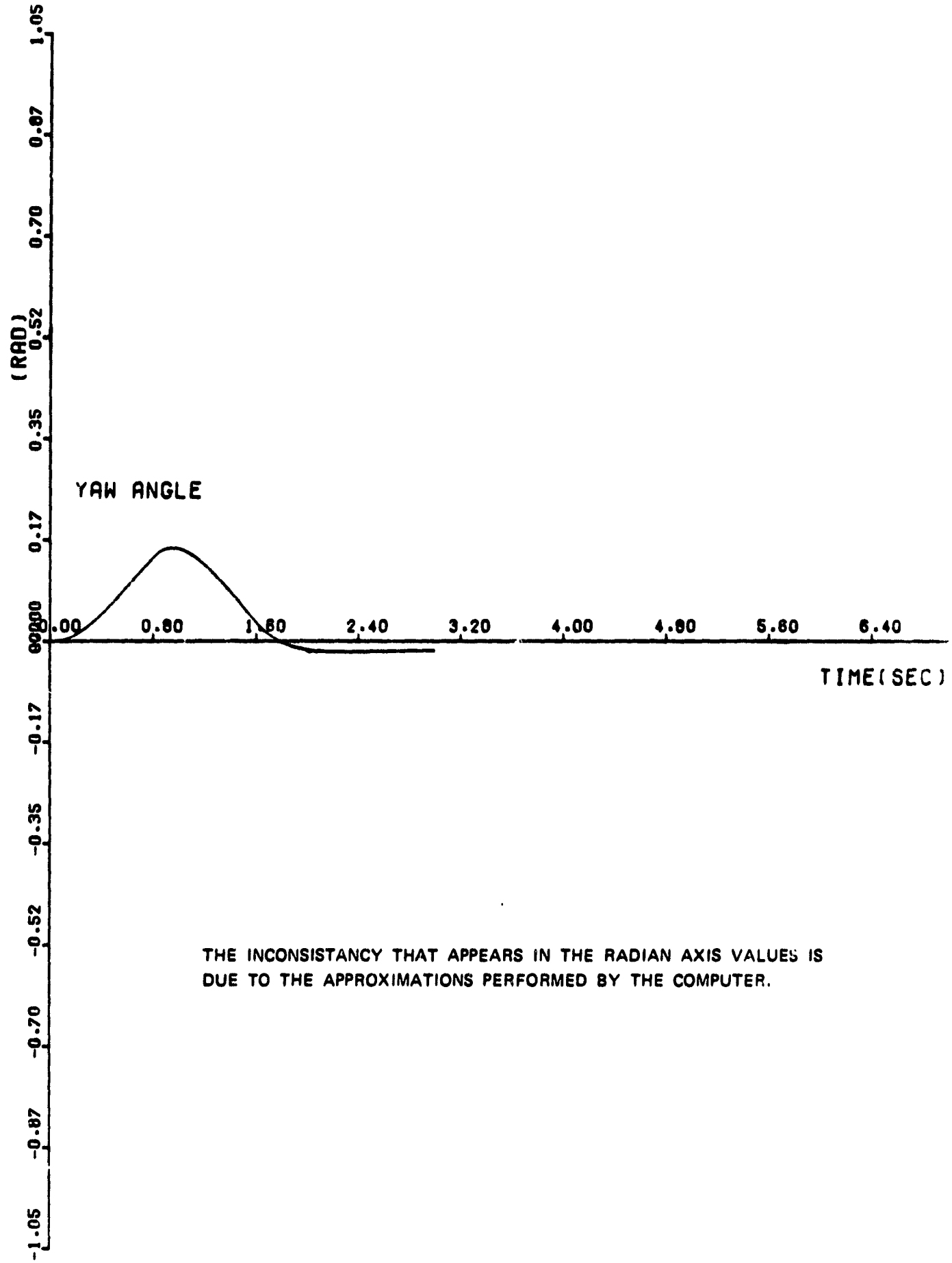
THE INCONSISTANCY THAT APPEARS IN THE RADIAN AXIS VALUES IS DUE TO THE APPROXIMATIONS PERFORMED BY THE COMPUTER.



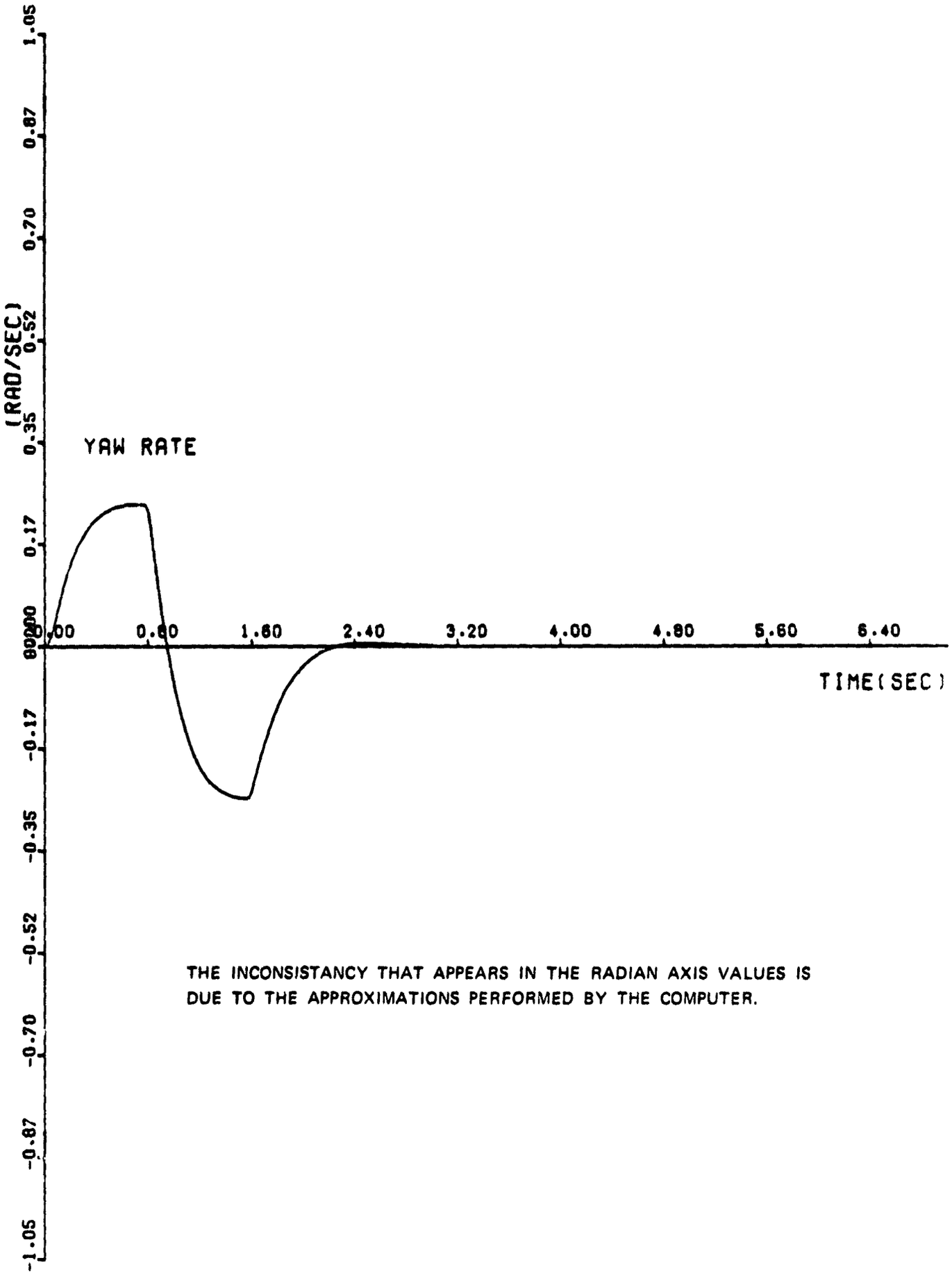
THE INCONSISTANCY THAT APPEARS IN THE RADIAN AXIS VALUES IS DUE TO THE APPROXIMATIONS PERFORMED BY THE COMPUTER.



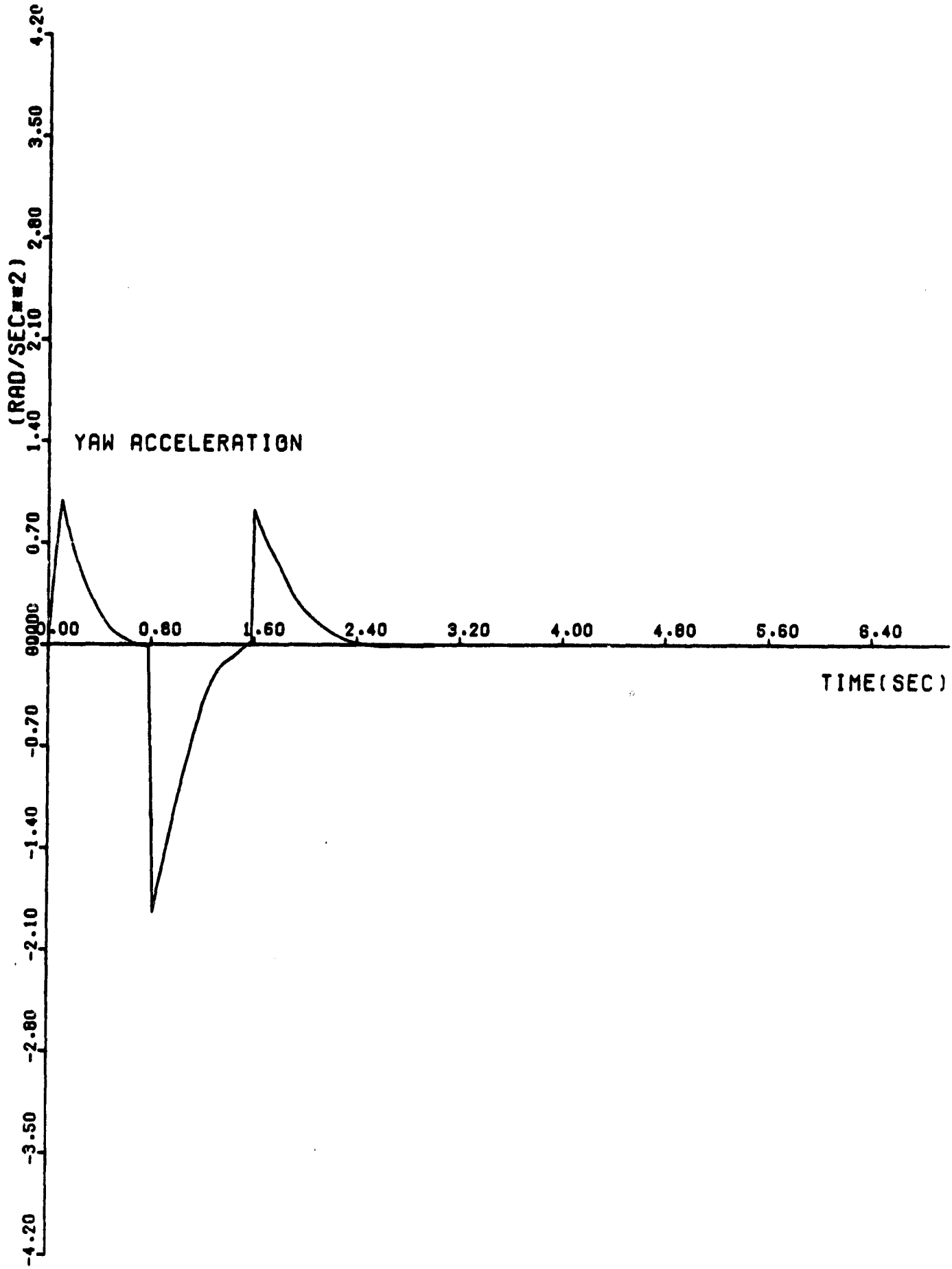
THE INCONSISTANCY THAT APPEARS IN THE RADIAN AXIS VALUES IS DUE TO THE APPROXIMATIONS PERFORMED BY THE COMPUTER.

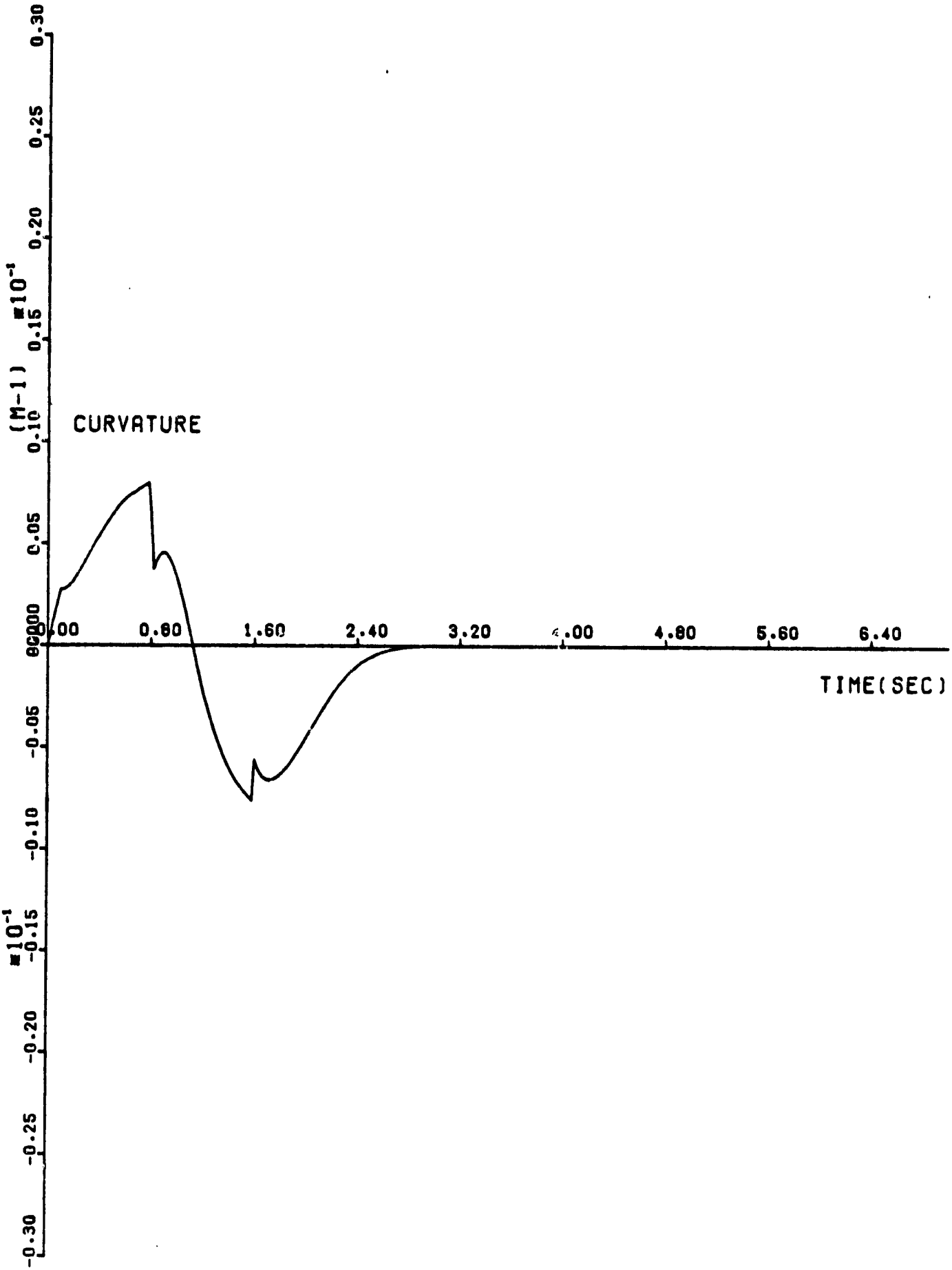


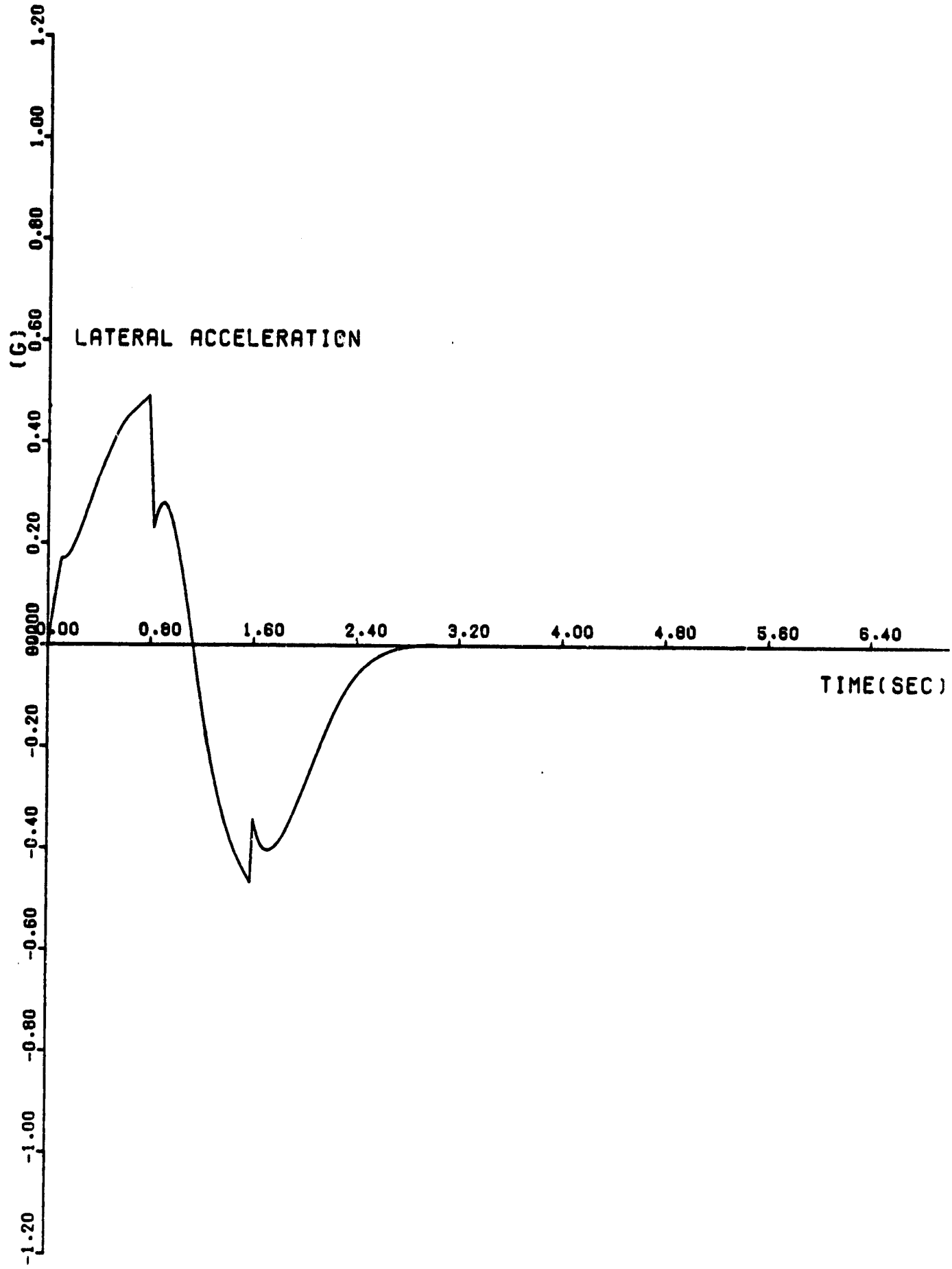
THE INCONSISTANCY THAT APPEARS IN THE RADIAN AXIS VALUES IS DUE TO THE APPROXIMATIONS PERFORMED BY THE COMPUTER.

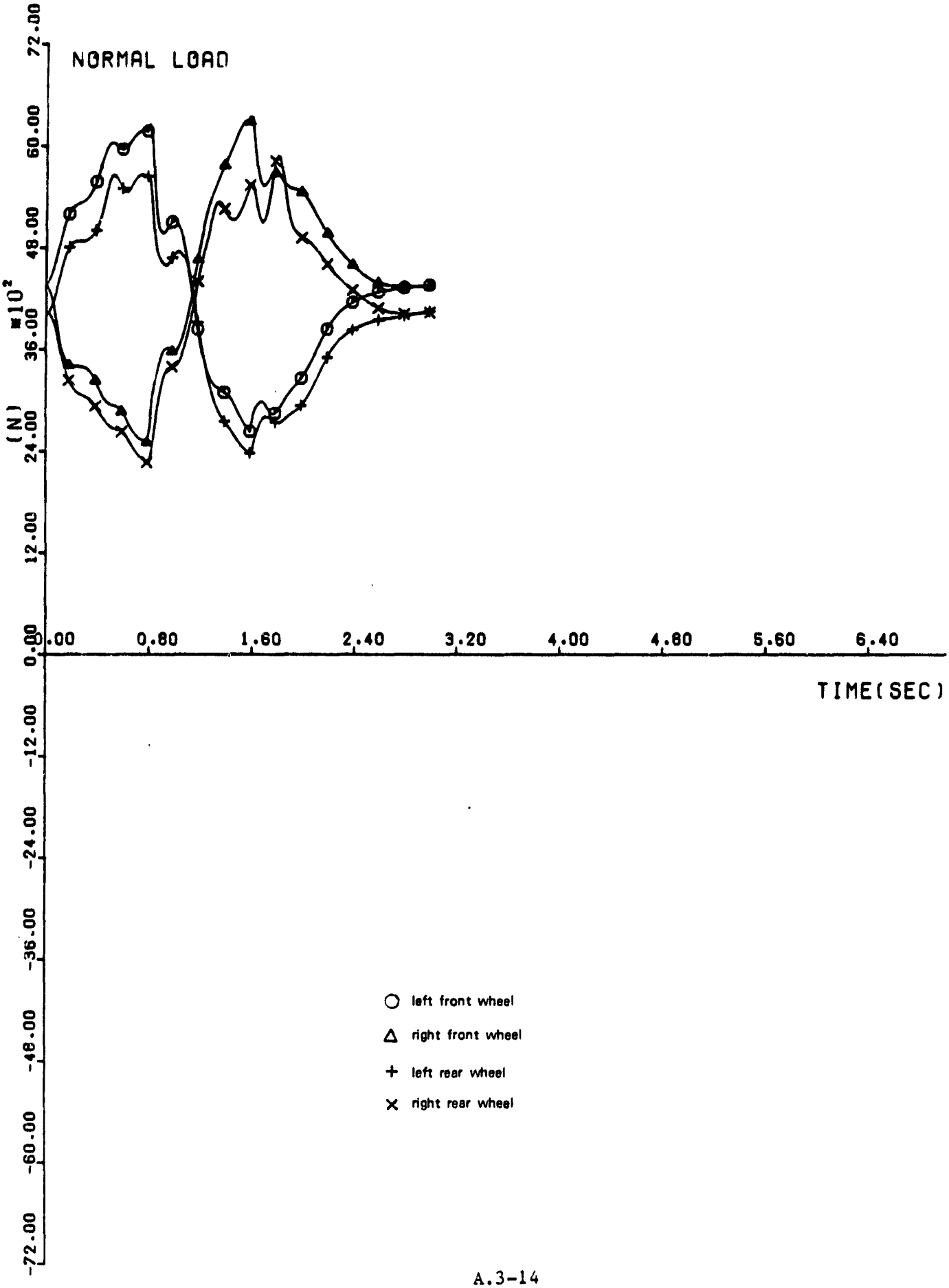


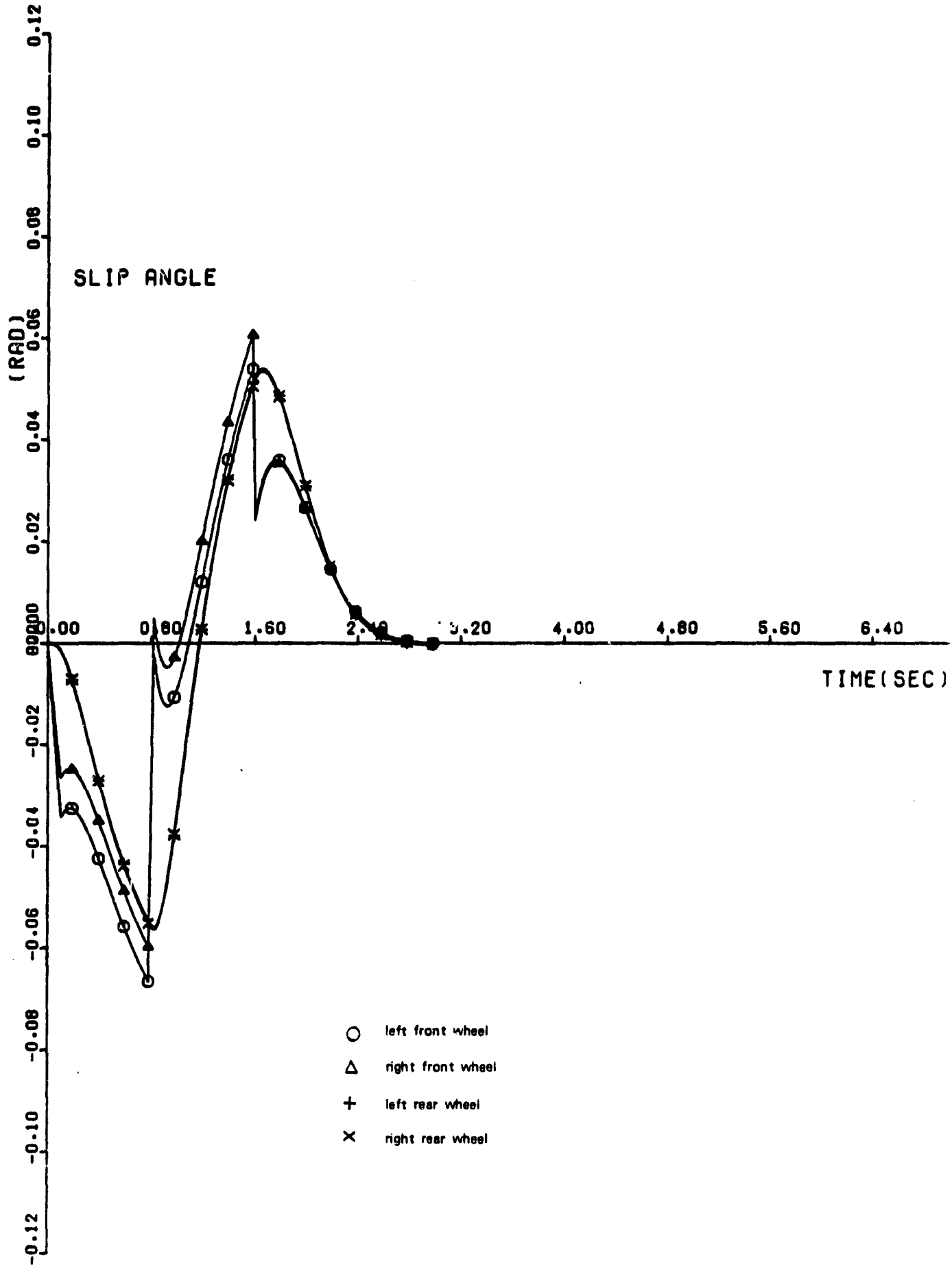
THE INCONSISTANCY THAT APPEARS IN THE RADIAN AXIS VALUES IS DUE TO THE APPROXIMATIONS PERFORMED BY THE COMPUTER.

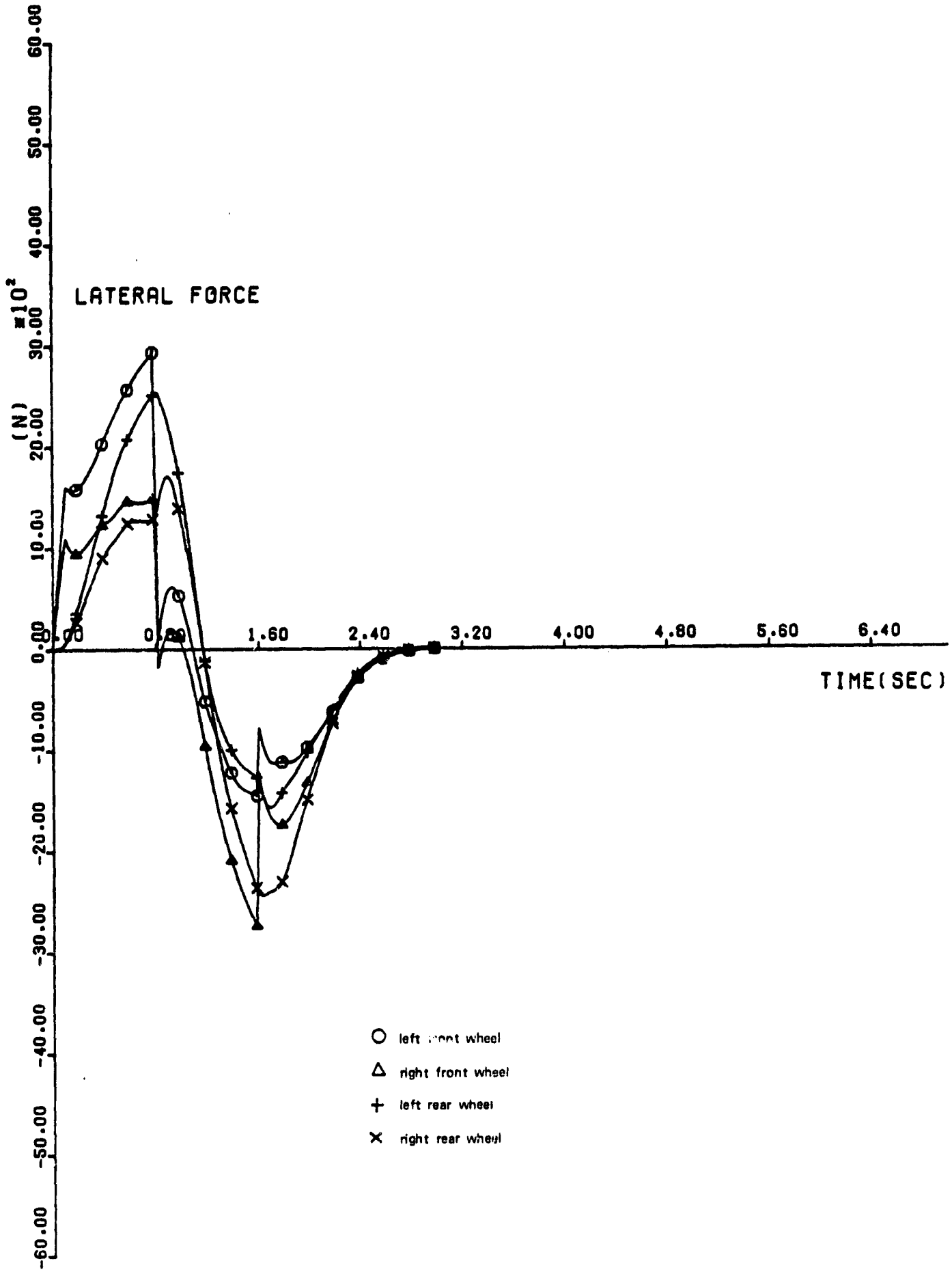

YAW ACCELERATION
(RAD/SEC**2)
4.20
3.50
2.80
2.10
1.40
0.70
0.00
-0.70
-1.40
-2.10
-2.80
-3.50
-4.20
0.00
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
TIME(SEC)

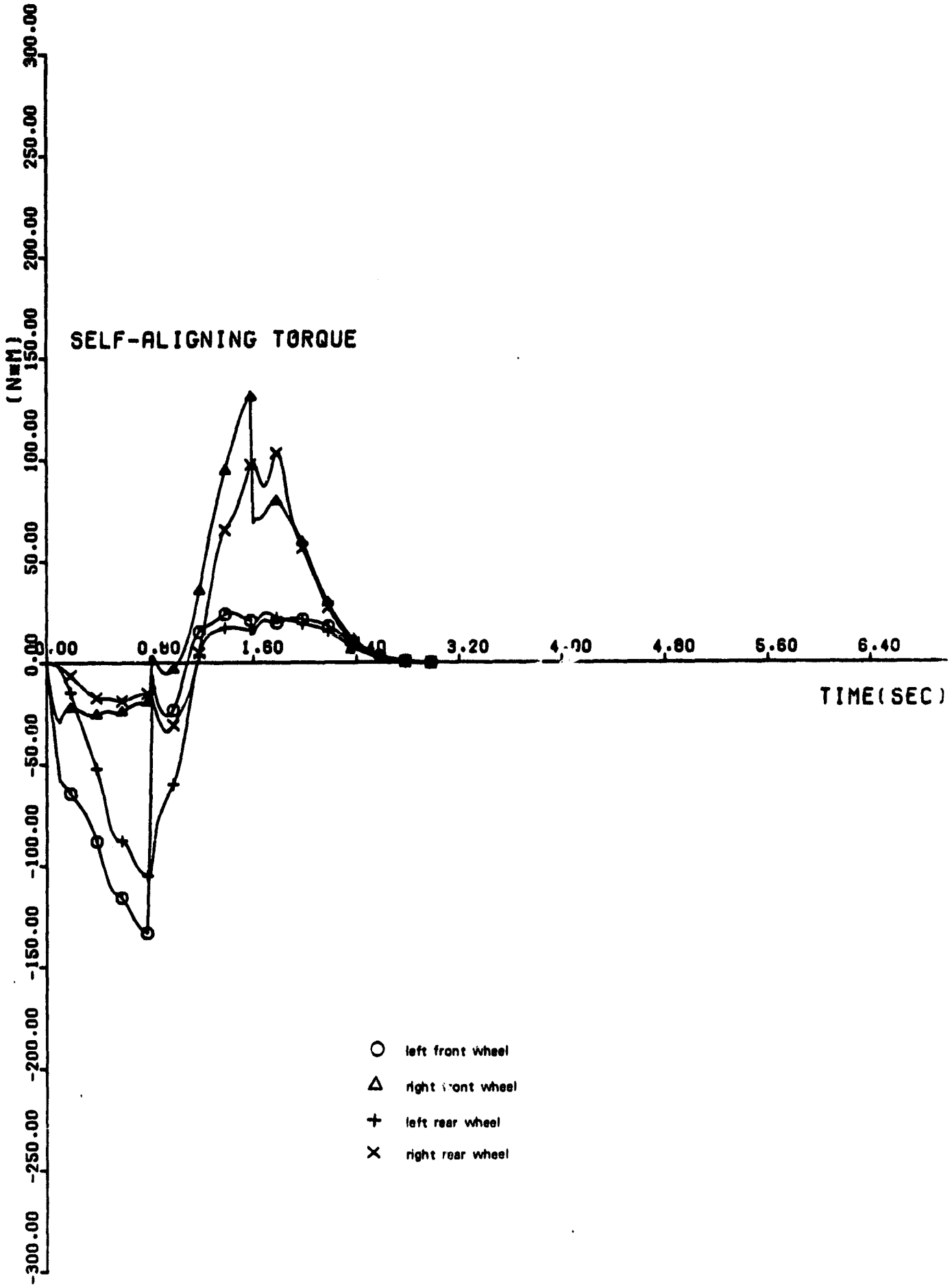

CURVATURE
(M-1) ×10⁻¹
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
0.00
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
TIME(SEC)


LATERAL ACCELERATION
(G)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
0.00
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
TIME(SEC)


NORMAL LOAD
72.00
60.00
48.00
36.00
24.00
12.00
0.00
-12.00
-24.00
-36.00
-48.00
-60.00
-72.00
(N) ×10²
0.00
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
TIME(SEC)
left front wheel
right front wheel
left rear wheel
right rear wheel


SLIP ANGLE
(RAD)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
0.80
1.60
4.00
4.80
5.60
6.40
TIME(SEC)
left front wheel
right front wheel
left rear wheel
right rear wheel


LATERAL FORCE
(N) ×10²
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
TIME(SEC)
left front wheel
right front wheel
left rear wheel
right rear wheel


SELF-ALIGNING TORQUE
(N=M)
300.00
250.00
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
-250.00
-300.00
.00
0.80
1.60
3.20
4.00
4.80
5.60
6.40
TIME(SEC)
left front wheel
right front wheel
left rear wheel
right rear wheel

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .0000               *
*                                                                           *
*****************************************************************************
*  VELOCITA' KM/H          =  60.4000        RAGGIO EFFETTIVO      =  INFINITO  *
*  ACCELERAZIONE LATERALE  =  .484096-056    CONTINGENZA EFFETTIVA =  .000000  *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$

X           =  .000000          VINX   =  24.5800          AINX   =  .620034-01
Y           =  .000000          VINY   =  .000000          AINY   =  .474011-04
Z           =  .341314-01       VINZ   =  .000000          AINZ   =  .948655-03
CURVATURA   =  .786048-07       VMORX  =  24.5741          AMORX  =  .619688-01
VELOCITA'   =  24.5800          VMORY  =  -.299564-06      AMORY  =  .474099-04
RAGGIO      =  .127219+08       VMORZ  =  .537638          AMORZ  =  .229663-02
PASSO INT.  =  .200000-01       PSTAR  =  -.537638-07      PPUNTOS=  .452071-04
CONTINGENZA=  .484110-05        QSTAR  =  -.136923-11      QPUNTOS=  .200376-0;
INDICE ESV  =  2.00225          RSTAR  =  .245741-05       RPUNTOS=  .211267-04

                     $$$$$ ANGOLI  VEICOLO $$$$$

            ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO      .306195-16        -        *     0G  0P   .0S         -
ASSETTO MIS.      .000000           -        *     0G  0P   .0S         -
IMBARDATA        -.306195-16      .245800-05  *     0G  0P   .0S       0G  0P   .5S      .211206-04
BECCHEGGIO        .218747-01      .000000     *     1G 15P 12.0S       0G  0P   .0S
ROLLIO           -.557185-06      .000000     *     0G  0P  -.1S       0G  0P   .0S
VOLANTE           .17500 -04      .000000     *     0G  0P  3.6S       0G  0P   .0S      .000000

                          $$$$$ R U O T E $$$$$

                  ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO             .947775-06        .000000            .757837-06        .000000
DERIVA            -.244279-05       -.104287-03         .992364-06        .104018-03
CONVERGENZA        .162239-05        .104148-03        -.162282-05       -.104158-03
CAMPANATURA        .567635-03        .189622-01        -.567577-03       -.189623-01
CAMP. RTF. AL SUOLO .218824-01       .289497-01        -.218824-01       -.289505-01
SCUOTIMENTO        .652960-02        .640445-01         .652880-02        .640437-01
VELOCITA' SCUOTIM.  .000000           .000000           .000000           .000000
VEL. DEF. LAT. PNEUM. .000000         .000000           .000000           .000000
CARICO  SCUOTIMENTO 3922.10           3630.92           3922.05           3630.88
  ''    LATERALE    .114988           4.60724          -.467128-01       -4.68471
  ''    LONGITUDINA. 241.884          -48.8983           241.885          -48.8977
QUOTA PESO+CAR.SCUOT. 4363.55         4023.32           4363.50           4023.28
MOMENTO AUTOALLIN.  -.421688-02       -.154175           .171272-02        .153762
  ''    RES. AL ROTOL. 16.4120        14.9150            16.4118           14.9148
  ''    FRENANTE      .000000         .000000           .000000           .000000
VEL.CENTRO RUOTA    24.5800           24.5800           24.5800           24.5800
VEL.ROTAZ. RUOTA    81.7993           80.3290           81.7993           80.3290
SCORRIMENTO         .147821-01       -.324099-02        .147823-01       -.324099-02

                       $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    449.896    =    4296.19    GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.86275   CV
COPPIA                 34.5216    =    3.51902    KGM       * POTENZA AERODINAMICA   =  9.35527   CV
POTENZA                15531.1    =    21.1092    CV
FARFALLA               .310696
COPPIA VOLANTE         .152592-03 *    RISULTANTE FORZE EXT. PARTC.      .000000
MARCIA INSERITA             3     *    RISULTANTE MOM. EXT. PARTC.       .000000
PRESS.CIRC.FRENANTE    .000000    *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .1000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.5027        RAGGIO EFFETTIVO      =  361.455   *
*   ACCELERAZIONE LATERALE  =  .178309   G    CONTINGENZA EFFETTIVA  =  .178445  *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$
X           =  2.45825          VINX   =  24.5839          AINX   = -.244568-02
Y           =  .295654-02       VINY   =  .867718-01       AINY   =  1.67287
Z           =  .341457-01       VINZ   =  .128245-02       AINZ   =  .738873-01
CURVATURA   =  .278659-02       VMORX  =  24.5781          AMORX  = -.883345-03
VELOCITA'   =  24.5841          VMORY  =  .358273-01       AMORY  =  1.67162
RAGGIO      =  361.455          VMORZ  =  .538544          AMORZ  =  .834028-01
PASSO INT.  =  .200000-01       PSTAR  = -.148777          PPUNTOS= -1.91544
CONTINGENZA =  .178445          QSTAR  = -.319381-02       QPUNTOS= -.116361
INDICE FSV  =  1.60082          RSTAR  =  .558531-01       PPUNTOS=  .988402

                       $$$$$ ANGOLI  VEICOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *     ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO    .158303-02        -        *     0G  5P 26.5S          -
ASSETTO MIS.    .000000           -        *     0G  0P   .0S          -
IMBARDATA       .194657-02     .558833-01  *     0G  6P 41.5S       3G 12P  6.6S      .989379
BECCHEGGIO      .218471-01    -.278242-02  *     1G 15P  6.3S       0G -9P 33.9S
ROLLIO         -.573895-02    -.139556     *    0G-19P 43.7S      -7G 59P 45.6S
VOLANTE         .723750        7.23733     *    41G 28P  4.1S     41G 4BP  5.6S      .369549-03

                          $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO              .387966-01        .000000            .310216-01        .000000
DERIVA             -.343393-01       -.186234-02        -.265531-01       -.145882-02
CONVERGENZA        -.475870-03        .931606-04        -.135416-03       -.115466-03
CAMPANATURA         .825440-03        .186355-01        -.231638-03       -.192302-01
CAMP. RIF. AL SUOLO-.224246-01        .253711-01        -.226418-01       -.331844-01
SCUOTIMENTO         .187426-01        .690511-01         .241670-02        .687862-01
VELOCITA' SCUOTIM.  .100000           .964824-01        -.949344-01       -.101797
VEL. DEF. LAT. PNEUM. .000000         .000000            .000000           .000000
CARICO  SCUOTIMENTO 4308.95           3965.48            3381.44           3337.95
  "     LATERALE    1607.59           79.1456            1895.88           61.6938
  "     LONGITUDIN. 241.810           -78.2319           238.763           -31.4981
QUOTA PESO+CAR.SCUOT. 4792.73         4307.67            3788.15           3698.53
MOMENTO AUTOALLIN.  -57.8874          -2.01255           -29.3688          -1.79195
  "     RES. AL ROTOL. 18.3653        16.5809            13.8533           13.4751
  "     FRENANTE    .000000           .000000            .000000           .000000
VEL.CENTRO RUOTA    24.6899           24.6238            24.5352           24.5439
VEL.ROTAZ. RUOTA    81.7849           80.3901            81.8214           80.2887
SCORRIMENTO         .134897-01       -.425874-02         .168433-01       -.227538-02

                       $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.   449.917    =   4296.30   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.82235   CV
COPPIA                34.5185    =   3.51878   KGM       * POTENZA AERODINAMICA   =  9.35993   CV
POTENZA               15530.5    =   21.1883   CV
FARFALLA              .310696
COPPIA VOLANTE        4.36184    *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA             3    *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE   .000000    *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .2000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.5027        RAGGIO EFFETTIVO      =  300.332   *
*   ACCELERAZIONE LATERALE  =  .199646   G    CONTINGENZA EFFETTIVA  =  .199812   *
*****************************************************************************
                          $$$$$ V E I C O L O $$$$$
X           =  4.91660          VINX   =  24.5027          AINX   = -.248594-01
Y           =  .201589-01       VINY   =  .262237          AINY   =  1.96001
Z           =  .347672-01       VINZ   =  .100542-01       AINZ   =  .644087-01
CURVATURA   =  .324326-02       VMOMX  =  24.5784          AMOMX  = -.287656-02
VELOCITA'   =  24.5841          VMOMY  = -.407812-01       AMOMY  =  1.95852
RAGGIO      =  300.332          VMOMZ  =  .527434          AMOMZ  =  .102668
PASSO INT.  =  .200000-01       PSTAR  = -.896141-01       PPUNTOS=  1.32090
CONTINGENZA=  .199812           DSTAR  = -.148701-01       DPUNTOS= -.612462-01
INDICE FSV  =  3.93325          RSTAR  =  .137012          RPUNTOS=  .627414

                       $$$$$ ANGOLI  VEICOLO $$$$$
          ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:       VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO   -.124819-02       -        *     0G -4P 15.8$          -
ASSETTO RIS.    .000000          -        *    414G 40P  5.6$          -
IMBARDATA       .119873-01      .137306   *     0G 40P 56.1$       7G 52P  1.4$      .628628
BECCHEGGIO      .210427-01     -.121957-01*     1G 12P 20.4$       0G-41P 55.5$
ROLLIO         -.105883-01     -.867251-01*    -1G  7P  2.2$      -4G 58P  0.3$
VOLANTE         .723750         .000000   *    41G 28P  4.2$       0G  0P   .0$      .000000

                          $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO               .387966-01        .000000           .310216-01        .000000
DERIVA              -.328673-01       -.906287-02        -.251418-01       -.802254-02
CONVERGENZA         -.962888-04        .712442-04         .549118-05       -.141543-03
CAMPANATURA          .108191-02        .176874-01         .686199-03       -.196094-01
CAMP. RIF. AL SUOLO -.279963-01       -.211224-01        -.282425-01       -.444804-01
SCUOTIMENTO          .223698-01        .784387-01        -.591275-02        .583593-01
VELOCITA' SCUOTIM.   .982279-01        .574864-01        -.382271-01       -.701256-01
VEL. DEF. LAT. PNEUM.  .000000          .000000           .000000          .000000
CARICO  SCUOTIMENTO  4752.06           4404.59           3014.15          2837.28
  "     LATERALE     1602.80            451.561           952.276          338.625
  "     LONGITUDIN.   217.876           -78.5638          252.607          -21.2071
UNITA PESO+CAR.SCUOT. 5251.85           4851.18           3398.67          3175.59
MOMENTO AUTOALLIN.   -66.1910          -18.4458          -22.2268         -7.59716
  "     RES. AL ROTOL.  20.5314          18.6646           12.2328          11.3197
  "     FRENANTE       .000000          .000000           .000000          .000000
VEL.CENTRO RUOTA      24.6691           24.6812           24.4768          24.4848
VEL.ROTAZ. RUOTA      81.7873           80.5726           81.8719          80.1318
SCORRIMENTO           .110645-01       -.431861-02        .198281-01       -.178781-02

                       $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    450.063     =    4297.78    GIRI/1'   • POTENZA DI ROTOLAMENTO =  6.87429    CV
COPPIA                 34.4970     =    3.51651    KGM       • POTENZA AERODINAMICA   =  9.35993    CV
POTENZA                15525.8     =    21.1028    CV
FARFALLA               .319696
COPPIA VOLANTE         4.50883     •    RISULTANTE FORZE EXT. RADIF.      .000000
MARCIA INSERITA              3     •    RISULTANTE MOM. EXT. RADIF.       .000000
PRESS.CIRC.FRENANTE    .000000     •    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .3000              *
*                                                                           *
*****************************************************************************
*  VELOCITA' KM/H          =  88.4904        RAGGIO EFFETTIVO      =  227.936  *
*  ACCELERAZIONE LATERALE  =  .270849   G    CONTINGENZA EFFETTIVA  =  .270265 *
*****************************************************************************

                          $$$$$  V E I C O L O  $$$$$

X          =  7.37468          VINX   =  24.9781          AINX   = -.748928-01
Y          =  .572526-01       VINY   =  .491257          AINY   =  2.65934
Z          =  .361592-01       VINZ   =  .170744-01       AINZ   =  .647497-01
CURVATURA  =  .438721-02       VMORX  =  24.9770          ANORX  = -.919777-03
VELOCITA'  =  24.5838          VMORY  = -.218232          ANORY  =  2.64918
RAGGIO     =  227.936          VMORZ  =  .490925          ANORZ  =  .196248
PASSO INT. =  .200000-01       PSTAR  = -.183572-01       PPUNTOS= -.139174
CONTINGENZA=  .270265          QSTAR  = -.144472-01       QPUNTOS=  .499396-01
INDICE FSV =  5.39179          RSTAR  =  .187981          RPUNTOS=  .385732

                      $$$$$  ANGOLI  VEICOLO  $$$$$

              ANGOLI DI:      VELOCITA' DI:   *     ANGOLI DI:       VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO   -.648317-02          -         *     0G-29P 53.39          -
ASSETTO MIS.    .000000             -         *     0G  0P   .00          -
IMBARDATA       .283481-01      .188223       *     1G 37P 35.55      1MG 47P  3.75      .384545
BECCHEGGIO      .198443-01     -.188834-01    *     1G  8P 13.25       0G-34P 39.83
ROLLIO         -.232854-01     -.146223-01    *    -1G 19P 46.59       0G-58P 16.15
VOLANTE         .72375          .000000       *     4G 28P  4.25      0G  0P   .03      .000000

                          $$$$$  R U O T E  $$$$$

                    ANT.SIN.        POST.SIN.       ANT.DES.        POST.DES.
STERZO              .387966-01       .000000        .318216-01       .000000
DERIVA             -.372714-01      -.198584-01     -.296831-01      -.198542-01
CONVERGENZA        -.208767-03       .669191-04      .783918-06      -.147592-03
CAMPANATURA         .968593-03       .174941-01      .658315-03      -.197788-01
CAMP. RIF. AL SUOLO -.298348-01     -.286761-01     -.298488-01      -.473345-01
SCUNTIMENTO         .279586-01       .888813-01     -.569685-02       .473887-01
VELOCITA' SCUNTIN.  .486374-01       .136584-01      .189536-01      -.787688-02
VEL. DEF. LAT. PNEUM.  .000000       .000000        .000000          .000000
CARICO  SCUOTIMENTO  4941.39         4418.48        3921.42          2726.39
   ''     LATERALE   1804.33         939.449        1185.96          669.928
   ''     LONGITUDIN.  218.344       -72.4827        269.857         -22.9048
QUOTA PESO+CAR.SCUOT. 5368.39        4883.74        3384.88          3845.89
MOMENTO AUTOALLIN.  -75.3149        -37.1351       -25.1841         -13.8855
   ''     RES. AL ROTOL.  21.9665       18.8297        12.1688          10.7917
   ''     FRENANTE    .000000       .000000        .000000          .000000
VEL.CENTRO RUOTA    24.6991         24.7151        24.4328          24.4445
VEL.ROTAZ. RUOTA    81.8371         89.7129        81.8488          79.9844
SCORRIMENTO         .184541-01      -.395340-02     .212654-01      -.281365-02

                      $$$$$  P T I  O T A G G I O  $$$$$

VELOCITA' DI ROTAZ.    458.134    =    4298.46    GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.88378   CV
COPPIA                 34.4865    =    3.51544    KGM       * POTENZA AERODINAMICA   =  9.35875   CV
POTENZA                15523.5    =    21.0090    CV
FARFALLA               .318606
COPPIA VOLANTE         5.11328    *    RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA            3      *    RISULTANTI MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000    *    RISULTANTI COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .4000                *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.4849        RAGGIO EFFETTIVO      =  100.462   *
*   ACCELERAZIONE LATERALE  =  .341212  G     CONTINGENZA EFFETTIVA  =  .341255  *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$

X          =  9.83108          VINX   =  24.5664          AINX   =  -.167009
Y          =  .120043          VINY   =  .792159          AINY   =  3.34404
Z          =  .381030-01       VINZ   =  .207572-01       AINZ   =  -.955797-02
CURVATURA  =  .554134-02       VMORX  =  24.5708          ANORX  =  -.410326-02
VELOCITA'  =  24.5701          VMORY  =  -.421742         ANORY  =  3.34720
RAGGIO     =  180.462          VMORZ  =  .481555          ANORZ  =  .887275-01
PASSO INT. =  .200000-01       PSTAR  =  -.691988-01      PPUNTOS=  -.325582
CONTINGENZA=  .341255          QSTAR  =  -.886661-02      QPUNTOS=  .637398-01
INDICE ESV =  6.25582          RSTAR  =  .218207          RPUNTOS=  .217419

                       $$$$$ ANGOLI  VETCOLO $$$$$

                ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO     -.166243-01          -         *     0G-57P  9.0S          -
ASSETTO MIS.      .000000             -         *     0G  0P   .0S          -
IMBARDATA         .488588-01       .218385      *     2G 47P 57.9S       126 38P 45.2S      .215650
BECCHEGGIO        .102075-01     -.217471-02     *     1G  6P  1.8S        0G -7P 28.6S
ROLLIO           -.269913-01     -.650044-01     *    -1G 32P 47.4S       -3G 43P 28.1S
VOLANTE           .723758          .000000      *     41G 28P  4.2S       0G  0P   .0S       .000000

                          $$$$$ R U O T E $$$$$

                ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO           .387966-01         .000000          .318216-01         .000000
DERIVA          -.437326-01        -.289174-01        -.363634-01        -.290766-01
CONVERGENZA     -.356468-03         .614119-04         .710026-06        -.150604-03
CAMPANATURA      .481836-03         .169148-01         .657145-03        -.197081-01
CAMP. RTF. AL SUOLO -.325894-01    -.216912-01        -.326956-01        -.585760-01
SCUOTIMENTO      .334544-01         .845684-01        -.560776-02         .457120-01
VELOCITA' SCUOTIM.  .783664-01      .648151-01        -.230868-01        -.287536-01
VEL. DEF. LAT. PNEUM.  .000000      .000000           .000000            .000000
CARICO  SCUOTIMENTO  5128.07        4585.86           2819.54            2587.74
   ''     LATERALE   2805.82        1415.85           1259.16            949.917
   ''     LONGITUDIN.  223.069      -68.9754           282.232           -24.1751
QUOTA PESO+CAR.SCUOT.  5678.55      5872.69           3168.37            2886.16
MOMENTO AUTOALLIN.  -92.3479        -56.5747          -25.8459           -17.4646
   ''     RES. AL ROTOL.  22.5696     19.7173           11.2356            10.1395
   ''     FRENANTE     .000000        .000000           .000000            .000000
VEL.CENTRO RUOTA    24.7876         24.7296           24.3985            24.4159
VEL.ROTAZ. RUOTA    81.8673         80.7866           81.9852            79.8719
SCORRIMENTO         .184982-01     -.362597-02        .221267-01        -.223366-02

                       $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.   458.909    =   4298.13   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.97294   CV
COPPIA                34.4916    =   3.51596   KGM       * POTENZA AERODINAMICA   =  9.35428   CV
POTENZA               15524.6    =   21.1064   CV
FARFALLA              .318696
COPPIA VOLANTE        6.92384    *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA          3       *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE   .000000    *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                  RISULTATI ALL' ISTANTE  T    =     .5000                 *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.4551        RAGGIO EFFETTIVO      =  153.500  *
*   ACCELERAZIONE LATERALE  =  .401006   G    CONTINGENZA EFFETTIVA  =  .400605  *
*****************************************************************************
                          $$$$$ V E I C O L O $$$$$
X           =  12.2876          VINX   =  24.9437          AINX   = -.291454
Y           =  .217763          VINY   =  1.15586          AINY   =  3.92144
Z           =  .395859-01       VINZ   =  .208238-02       AINZ   = -.355641
CURVATURA   =  651001-02        VMORX  =  24.9589          AMORX  = -.344694-02
VELOCITA'   =  24.9789          VMORY  = -.617199          AMORY  =  3.94171
RAGGIO      =  153.588          VMORZ  =  .455825          AMORZ  = -.228188
PASSO INT.  =  .200000-01       PSTAR  = -.241942-01       PPUNTOS=  .020006
CONTINGENZA=  .400695           QSTAR  = -.662864-02       QPUNTOS= -.518038-01
INDICE ESV  =  6.69518          RSTAR  =  .233507          RPUNTOS=  .961407-01

                      $$$$$ ANGOLI  VETCOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *     ANGOLI DI:          VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO    -.245078-01         -          *   -16 24P 14.9S          -
ASSETTO RIS.     .000000            -          *    0G  0P   .0S          -
IMBARDATA        .715663-01      .233723       *    4G  6P  1.6S      13G 23P 20.8S      .977003-01
BECCHEGGIO       .192781-01      .947307-03    *    1G  6P 16.4S       0G  3P 15.4S
ROLLIO          -.324242-01     -.196807-01    *   -1G 51P 28.0S      -1G  7P 41.1S
VOLANTE          .723750         .000000       *   41G 28P  4.2S       0G  0P   .0S      .000000

                          $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO              .387966-01        .000000            .310216-01        .000000
DERIVA             -.585529-01       -.376034-01        -.435143-01       -.370803-01
CONVERGENZA        -.567677-03        .571043-04        -.244370-05       -.154238-03
CAMPANATURA         .257208-03        .161286-01         .997688-03       -.198233-01
CAMP. RTF. AL SUOLO -.375048-01       -.252488-01        -.368833-01       -.356087-01
SCUOTIMENTO         .387841-01        .988437-01        -.822184-02        .433836-01
VELOCITA' SCUOTIM.  .151262-01        .187142-01        -.141676-01       -.113567-01
VEL. DEF. LAT. PNEUM.  .000000        .000000            .000000           .000000
CARICO  SCUOTIMENTO  5478.81          5149.28           2626.89           2498.28
   "    LATERALE     2376.22          1845.36           1367.82           1191.83
   "    LONGITUDIN.   232.282         -72.5688           259.259          -23.3413
QUOTA PESO+CAR.S.UNT.  6839.81        5653.54           2949.78           2681.18
MOMENTO AUTOALLIN.  -111.625          -83.1881          -24.8736          -17.8758
   "    RES. AL ROTOL.  24.3855         22.4067           10.3814           9.32783
   "    FRENANTE     .000000           .000000           .000000           .000000
VEL.CENTRO RUOTA    24.6992           24.7274           24.3688           24.3913
VEL.ROTAZ. RUOTA    81.8198           80.7061           81.8154           79.7857
SCORRIMENTO         .102534-01       -.342252-02        .234376-01       -.232158-02

                        $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    449.097     =    4287.15   GIRI/1'   * POTENZA DI ROTOLAMENTO =  7.29127   CV
COPPIA                 34.5068     =    3.51751   KGM       * POTENZA AERODINAMICA   =  9.34484   CV
POTENZA                15527.0     =    21.1949   CV
FARFALLA               .319696
COPPIA VOLANTE         7.01553     *    RISULTANTE FORZE EXT. MARIC.      .000000
MARCIA INSERITA              3     *    RISULTANTE MOM. EXT. MARIC.       .000000
PRESS.CIRC.FRENANTE    .000000     *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .6000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.4006        RAGGIO EFFETTIVO      =  137.953   *
*   ACCELERAZIONE LATERALE  =  .445833  G     CONTINGENZA EFFETTIVA  =  .445630   *
*****************************************************************************
                              $$$$$ V E I C O L O $$$$$
X           =  14.7403          VINX   =  24.5876              AINX   = -.429062
Y           =  .353783          VINY   =  1.37183              AINY   =  4.35313
Z           =  .383578-01       VINZ   = -.288777-01           AINZ   = -.519556-01
CURVATURA   =  .724893-02       VMORX  =  24.5418              AMORX  = -.125918-01
VELOCITA'   =  24.5588          VMORY  = -.782334              AMORY  =  4.37362
RAGGIO      =  137.953          VMORZ  =  .424108              AMORZ  =  .924848-01
PASSO INT.  =  .200000-01       PSTAR  = -.267828-01           PPUNTOS= -.618368
CONTINGENZA=  .445639           QSTAR  = -.991466-02           QPUNTOS= -.478384-03
INDICE FSV  =  6.88624          RSTAR  =  .244192              RPUNTOS=  .368326-01

                          $$$$$ ANGOLI  VEICOLO $$$$$
              ANGOLI DI:      VELOCITA' DI:   *      ANGOLI DI:        VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO    -.312731-01         -         *     -1G 47P 38.5S          -
ASSETTO RIS.     .000000            -         *      0G  0P   .0S          -
IMBARDATA        .953219-01      .240393      *      5G 27P 41.6S       13G 46P 24.5S      .360358-01
BECCHEGGIO       .101777-01     -.196712-02   *      1G  5P 55.7S        0G -6P 45.7S
ROLLIO          -.338773-01     -.221729-01   *     -1G 53P 42.7S       -1G 16P 13.5S
VOLANTE          .723758        .000000      *     41G 28P  4.2S        0G  0P   .0S      .000000

                              $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO               .387966-01        .000000           .310216-01        .000000
DERIVA              -.569586-01       -.446065-01        -.499762-01       -.451154-01
CONVERGENZA         -.539463-03        .574714-04        -.613857-05       -.156687-03
CAMPANATURA          .315163-03        .162573-01         .122314-02       -.198318-01
CAMP. RIF. AL SUOLO -.379671-01       -.255893-01        -.372882-01       -.562755-01
SCUOTIMENTO          .381578-01        .891477-01        -.979133-02        .415417-01
VELOCITA' SCUOTIM.  -.288178-02       -.825515-02        -.338776-01       -.391867-01
VEL. DEF. LAT. PNEUM.  .000000          .000000           .000000          .000000
CARICO  SCUOTIMENTO  5397.73          4943.68           2512.14          2333.86
  ''     LATERALE    2618.16          2126.53           1465.62          1263.41
  ''     LONGITUDIN.  231.932           -66.9359          259.595          -22.8847
QUOTA PESO+CAR.SCUOT. 5973.84          5462.27           2818.73          2688.65
MOMENTO AUTOALLIN.   -117.323          -88.3261          -23.4791         -18.6484
  ''     RES. AL ROTOL. 24.8462         21.5629           9.85553          8.89014
  ''     FRENANTE     .000000           .000000           .000000          .000000
VEL.CENTRO RUOTA     24.6882           24.7149           24.3414          24.3687
VEL.ROTAZ. RUOTA     81.7654           80.7664           81.8173          79.7188
SCORRIMENTO          .103546-01       -.326777-02        .245591-01       -.234653-02

                            $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.   449.852    =    4295.77   GIRI/1'   * POTENZA DI ROTOLAMENTO =  7.89579   CV
COPPIA                34.5281    =    3.51968   KGM       * POTENZA AERODINAMICA   =  9.33812   CV
POTENZA               15532.5    =    21.1112   CV
FARFALLA              .310696
COPPIA VOLANTE        7.29548    *    RISULTANTE FORZE EXT. RARIF.      .000000
MARCIA INSERITA          3       *    RISULTANTE MOM. EXT. RARIF.       .000000
PRESS.CIRC.FRENANTE   .000000    *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .7000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.3478        RAGGIO EFFETTIVO      =  130.360   *
*   ACCELERAZIONE LATERALE  =  .470391   G    CONTINGENZA EFFETTIVA  =  .470947   *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$
X          =  17.1886          VINX   =  24.4578          AINX   =  -.555935
Y          =  .533158          VINY   =  2.01946          AINY   =  4.58099
Z          =  .362728-01       VINZ   =  -.196973-01      AINZ   =  .388337-01
CURVATURA  =  .767185-02       VMOBX  =  24.5201          ANOBX  =  -.155228-01
VELOCITA'  =  24.5411          VMOBY  =  -.925938         ANOBY  =  4.61944
RAGGIO     =  130.360          VMOBZ  =  .412681          ANOBZ  =  .291318
PASSO INT. =  .200000-01       PSTAR  =  -.441383-01      PPUNTOS=  .338064
CONTINGENZA=  .470947          QSTAR  =  -.184708-01      QPUNTOS=  -.189267-01
INDICE ESV =  6.92956          RSTAR  =  .241639          RPUNTOS=  -.151579-02

                      $$$$$ ANGOLI  VETCOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO   -.370883-01        -        *     -2G  7P 30.0S          -
ASSETTO MIS.    .000000           -        *     0G  0P   .0S          -
IMBARDATA       .119470          .241985   *     6G 58P 42.5S       13G 51P 36.5S     -.118946-02
BECCHEGGIO      .100212-01    -.149639-02  *     1G  5P 23.4S        0G -5P  8.7S
ROLLIO         -.371184-01    -.395372-01  *     -2G  7P 36.2S      -2G 15P 55.1S
VOLANTE         .723758          .000000   *     41G 28P  4.2S       0G  0P   .0S      .000000

                          $$$$$ R U O T E $$$$$
                  ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO            .387966-01       .000000         .310216-01       .000000
DERIVA           -.625916-01      -.585637-01      -.557261-01      -.519672-01
CONVERGENZA      -.586988-03       .572092-04      -.285557-04      -.160513-03
CAMPANATURA       .217589-03       .161658-01       .197995-02      -.198817-01
CAMP. RTF. AL SUOLO -.415171-01   -.382980-01      -.399851-01      -.688121-01
SCUOTIMENTO       .392011-01       .897498-01      -.145868-01       .363227-01
VELOCITA' SCUOTIM.  .109371-01     .667842-02      -.465896-01      -.584631-01
VEL. DEF. LAT. PNEUM. .000000      .000000         .000000          .000000
CARICO  SCUOTIMENTO  5566.77        5118.32         2278.54          2113.52
  ''    LATERALE     2806.29        2368.54         1456.01          1266.58
  ''    LONGITUDIN.   248.748        -66.7176        252.151          -28.2945
QUOTA PESO+CAR.SCUOT. 6158.38       5636.78         2578.87          2372.68
MOMENTO AUTOALLIN.  -128.636       -108.417        -19.9189         -16.8332
  ''    RFS. AL ROTOL. 24.9188       22.3976         8.87938          8.12897
  ''    FRENANTE      .000000        .000000         .000000          .000000
VEL.CENTRO RUOTA     24.6537        24.6933         24.3138          24.3453
VEL.ROTAZ. RUOTA     81.6845        88.7862         81.8598          79.6386
SCORRIMENTO       .104388-01      -.315638-02       .261629-01      -.228899-02

                        $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.   449.745    =   4294.74   GIRI/1'   * POTENZA DI ROTOLAMENTO =  7.83462   CV
COPPIA                34.5448    =   3.52131   KGM       * POTENZA AERODINAMICA   =  9.31888   CV
POTENZA               15536.0    =   21.115    CV
FARFALLA              .310606
COPPIA VOLANTE        7.74931    *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA            3     *   RISULTANTE MOM. EXT. BARIC.       .000000
PPESS.CTRC.FRENANTE   .000000    *   RISULTANTE COMP. VELOC. VENTO     .000000
```

RISULTATI ALL' ISTANTE T = .000

VELOCITA' KM/H	= 80.2799	RAGGIO EFFETTIVO	= 165.458
ACCELERAZIONE LATERALE	= .370300 G	CONTINGENZA EFFETTIVA	= .370496

$$$$$ V E I C O L O $$$$$

X	= 19.6314	VINX	= 24.3967	AINX	= -.455772
Y	= .759338	VINY	= 2.47798	AINY	= 3.60697
Z	= .345972-01	VINZ	= -.131233-01	AINZ	= -.183767-01
CURVATURA	= .604414-02	VMORX	= 24.4960	AMORX	= .652130-01
VELOCITA'	= 24.5222	VMORY	= -1.05529	AMORY	= 3.63265
RAGGIO	= 165.458	VMORZ	= .400947	AMORZ	= .133078
PASSO INT.	= .200000-01	PSTAR	= .167678-01	PPUNTOS	= 3.21979
CONTINGENZA	= .370496	QSTAR	= -.687424-02	QPUNTOS	= .252304
INDICE FSV	= .109478+07	RSTAR	= .232989	RPUNTOS	= -.825965

$$$$$ ANGOLI VETCOLO $$$$$

	ANGOLI DI:	VELOCITA' DI:	*	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	-.423597-01	-	*	-2G 25P 37.3S	-	
ASSETTO MIS.	.000000	-	*	0G 0P .0S	-	
IMBARDATA	.143580	.233121	*	8G 13P 35.4S	13G 21P 24.7S	-.835353
BECCHEGGIO	.189414-01	.224622-02	*	1G 5P 6.9S	0G 7P 43.3S	
ROLLIO	-.391328-01	.211832-01	*	-2G 14P 31.7S	1G 12P 49.4S	
VOLANTE	.445545-05	-.903756-03	*	0G 0P .9S	0G -3P 6.4S	10856.0

$$$$$ R U O T E $$$$$

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	.238834-06	.000000	.190978-06	.000000
DERIVA	-.294774-01	-.553347-01	-.384236-01	-.558786-01
CONVERGENZA	-.581728-03	.573476-04	-.536144-04	-.168536-03
CAMPANATURA	.228413-03	.162178-01	.250828-02	-.197438-01
CAMP. RIF. AL SUOLO	-.432685-01	-.297307-01	-.412389-01	-.618452-01
SCUOTIMENTO	.398884-01	.894138-01	-.176042-01	.338823-01
VELOCITA' SCUOTIM.	-.310708-01	-.249818-01	-.101872-02	.487967-02
VEL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	5668.14	5868.41	2373.54	2821.29
" LATERALE	1482.82	2540.46	690.280	1382.54
" LONGITUDIN.	289.199	-61.4217	261.967	-20.8883
QUOTA PESO+CAR.SCUOT.	6259.24	5594.08	2666.44	2273.37
MOMENTO AUTOALLIN.	-88.1698	-104.272	-14.6333	-15.2443
" RES. AL ROTOL.	25.4745	22.1748	9.25559	7.75908
" FRENANTE	.000000	.000000	.000000	.000000
VEL.CENTRO RUOTA	24.6649	24.6631	24.3264	24.3274
VEL.ROTAZ. RUOTA	81.5957	80.6258	81.9844	79.5672
SCORRIMENTO	.891264-02	-.292794-02	.261989-01	-.244307-02

$$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.	449.625	=	4293.60	GIRI/1'	* POTENZA DI ROTOLAMENTO	= 7.86531	CV
COPPIA	34.5617	=	3.52311	KGM	* POTENZA AERODINAMICA	= 9.28941	CV
POTENZA	15539.8	=	21.1210	CV			
FARFALLA	.318696						
COPPIA VOLANTE	4.92424	*	RISULTANTE FORZE EXT. RAPIC.		.000000		
MARCIA INSERITA	3	*	RISULTANTE MOM. EXT. RAPIC.		.000000		
PRESS.CIRC.FRENANTE	.000000	*	RISULTANTE CORP. VELOC. VENTO		.000000		

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =     .0000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.2672        RAGGIO EFFETTIVO      =  218.883   *
*   ACCELERAZIONE LATERALE  =  .279078   G    CONTINGENZA EFFETTIVA  =   .279079  *
*****************************************************************************
                              $$$$$ V E I C O L O $$$$$
X           =  22.9695          VINX   =  24.3648          AINX   = -.336451
Y           =  1.81943          VINY   =  2.74226          AINY   =  2.72598
Z           =  .339814-01       VINZ   =  .973888-02       AINZ   =  .276928
CURVATURA   =  .456865-02       VMOBX  =  24.4864          AMOBX  =  .935858-01
VELOCITA'   =  24.5187          VMOBY  = -1.16828          AMOBY  =  2.73775
RAGGIO      =  218.883          VMOBZ  =  .484521          AMOBZ  =  .341841
PASSO INT.  =  .200000-01       PSTAR  =  .152681          PPUNTOS=  -2.23435
CONTINGENZA=  .279978           QSTAR  =  .280837-01       QPUNTOS=   .915725-01
INDICE ESV  = -2.85538          RSTAR  =  .722361-01       RPUNTOS=  -1.48655

                          $$$$$ ANGOLI  VEICOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *     ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO   -.468694-01        -        *     -2G 41P  7.59        -
ASSETTO MIS.    .000000           -        *      0G -3P  6.45        -
IMBARDATA       .158948          .717513-01*      9G  6P 25.39       4G  6P 39.09    -1.48857
BECCHEGGIO      .284714-01       .225593-01*      1G 18P 22.59       1G 17P 33.25
ROLLIO         -.229979-01       .154149   *     -1G 19P  3.69       0G 49P 55.69
VOLANTE        -.723758          .000000   *    -41G 28P  4.25       0G  0P   .05     .000000

                              $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO             -.318216-01        .000000          -.387966-01        .000000
DERIVA             -.118683-01       -.589597-01       -.441125-02       -.589481-01
CONVERGENZA        -.136538-03        .694767-04       -.388389-05       -.149879-03
CAMPANATURA         .184816-02        .175785-01        .183768-02       -.197981-01
CAMP. RIF. AL SUOLO-.299917-01       -.211781-01       -.299942-01       -.474317-01
SCUOTIMENTO         .248436-01        .793647-01       -.858682-02        .462464-01
VELOCITA' SCUOTIM.  -.131883         -.785551-01        .936456-01        .153489
VEL. DEF. LAT. PNEUM.  .000000        .000000          .000000           .000000
CARICO  SCUOTIMENTO 4446.16           4159.29          3184.83           2892.85
  ''    LATERALE    592.386           2226.72          177.871           1715.14
  ''    LONGITUDIN. 247.464          -22.8598          264.383          -65.8441
QUOTA PESO+CAR.SCUOT. 4972.58         4632.18          3541.26           3284.86
MOMENTO AUTOALLIN.  -24.7543         -78.7768         -4.82491          -32.5355
  ''    RES. AL ROTOL. 19.1763          17.6851          12.8217           11.4278
  ''    FRENANTE    .000000           .000000          .000000           .000000
VEL.CENTRO RUOTA    24.5643           24.5428          24.4618           24.4389
VEL.ROTAZ. RUOTA    81.6228           80.3624          81.8202           79.6886
SCORRIMENTO         .132711-01       -.131599-02       .199086-01       -.547878-02

                            $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    449.491    =    4292.32    GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.66823   CV
COPPIA                 34.5816    =    3.52514    KGM       * POTENZA AERODINAMICA   =  9.28541   CV
POTENZA                15544.1    =    21.1269    CV
FARFALLA               .318696
COPPIA VOLANTE         1.31967    *    RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA              3    *    RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000    *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.0000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.2625        RAGGIO EFFETTIVO      =  305.678   *
*   ACCELERAZIONE LATERALE  =  .200287   G    CONTINGENZA EFFETTIVA  =   .200454  *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$

X          =  24.5043          VINX   =  24.3349          AINX   = -.238249
Y          =  1.38549          VINY   =  2.98571          AINY   =  1.95295
Z          =  .357206-01       VINZ   =  .198946-01       AINZ   = -.235885-01
CURVATURA  =  .327141-02       VMORX  =  24.4935          AMORX  =  .829283-01
VELOCITA'  =  24.5174          VMORY  = -.922855          AMORY  =  1.96481
RAGGIO     =  305.678          VMORZ  =  .563592          AMORZ  =  .142712-01
PASSO INT. =  .200000-01       PSTAR  = -.128345-01       PPUNTOS=  .156756
CONTINGENZA=  .200454          QSTAR  =  .254378-01       QPUNTOS= -.118858-01
INDICE FSV =  1.67334          RSTAR  = -.579437-01       RPUNTOS= -1.87248

                        $$$$$ ANGOLI  VEICOLO $$$$$

          ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO   -.371899-01       -        *     -2G  7P 51.85          -
ASSETTO MIS.    .000000          -        *      0G  0P   .05          -
IMBARDATA       .159272       -.584148-01 *      9G  7P 32.39       -3G 2PP 48.95    -1.87235
BECCHEGGIO     .228748-01      .243723-01 *      1G 18P 38.39        1G 2P 47.15
ROLLIO         -.183022-01     -.133706-01 *     -1G  2P 55.19       0G-45P 57.95
VOLANTE        -.723758         .000000    *    -41G 28P  4.25       9G  PP   .05      .000000

                          $$$$$ R U O T E $$$$$

                  ANT.SIN.        POST.STN.        ANT.DES.        POST.DES.
STERZO          -.318216-01       .000000        -.387966-01       .000000
DERIVA          -.917637-02      -.340179-01      -.133115-02      -.337841-01
CONVERGENZA     -.673258-04       .654857-04       .125993-06      -.131234-03
CAMPANATURA      .188545-02       .173661-01       .750155-03      -.195456-01
CAMP. RTF. AL SUOLO -.286038-01  -.228954-01      -.288096-01      -.442222-01
SCUOTIMENTO      .201421-01       .811069-01      -.548185-02       .547624-01
VELOCITA' SCUOTIM. -.211162-02    .628254-01      -.195207-01       .455471-01
VEL. DEF. LAT. PNEUM. .000000     .000000          .000000          .000000
CARICO  SCUOTIMENTO  4586.29      4267.38          3194.12          3875.93
  ''    LATERALE     463.315      1593.31          54.2872          1256.58
  ''    LONGITUDIN.  288.929     -31.9628          218.181         -71.9816
QUOTA PESO+CAR.SCUOT. 5116.39     4724.57          3566.79          3483.89
MOMENTO AUTOALLIN.  -28.3754      -56.3823        -1.58729         -28.4314
  ''    RES. AL ROTOL.  19.8892    17.9912          12.9589          12.2732
  ''    FRENANTE      .000000      .000000          .000000          .000000
VEL.CENTRO RUOTA    24.4778       24.4593          24.5627          24.5428
VEL.ROTAZ. RUOTA    81.4828       80.8496          81.8689          80.8144
SCORRIMENTO          .158598-01  -.189486-02       .163121-01      -.563923-02

                        $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.   449.215    =   4289.59   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.88665   CV
COPPIA                34.6225    =   3.52931   KGM       * POTENZA AERODINAMICA   =  9.28304   CV
POTENZA               15553.0    =   21.1389    CV
FARFALLA              .318596
COPPIA VOLANTE        .954135    *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA             3    *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE   .000000    *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                  RISULTATI ALL' ISTANTE  T    =    1.1000                 *
*                                                                           *
*****************************************************************************
*  VELOCITA' KM/H          =  88.2720        RAGGIO EFFETTIVO      =  INFINITO  *
*  ACCELERAZIONE LATERALE  =  .399163-01G    CONTINGENZA EFFETTIVA =  .000000   *
*****************************************************************************
                          $$$$$ V E I C O L O $$$$$
X          =  26.937M          VINX   =  24.3224              AINX   = -.111565-01
Y          =  1.61242          VINY   =  3.10699              AINY   =  .392549
Z          =  .373319-01       VINZ   =  .194867-01           AINZ   = -.126948
CURVATURA  =  .649998-03       VMORX  =  24.5064              AMORX  =  .582282-01
VELOCITA'  =  24.5288          VMORY  = -.536745              AMORY  =  .391579
RAGGIO     =  1539.47          VMORZ  =  .613991              AMORZ  = -.120219
PASSO INT. =  .200000-01       PSTAR  =  .136185              PPUNTOS=  1.09373
CONTINGENZA=  .398367-01       QSTAR  =  .156844-01           QPUNTOS= -.224063
INDICE ESV =  4.27792          RSTAR  = -.149989              RPUNTOS= -.724984

                      $$$$$ ANGOLI  VEICOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO   -.215426-01          -        *     -1G 14P  3.5S          -
ASSETTO MIS.    .000000             -        *      0G  0P   .0S          -
IMBARDATA       .148593        -.149338      *      0G 30P 49.4S     -0G 33P 23.2S    -.721852
BECCHEGGIO      .249222-01      .136184-01   *      1G 25P 40.6S      0G 46P 48.6S
ROLLIO         -.138613-01      .132383      *     0G-47P 39.1S      7G 35P  6.0S
VOLANTE        -.723758         .000000      *    -41G 28P  4.2S      0G  0P   .0S     .000000

                          $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO             -.318216-01        .000000          -.387966-01        .000000
DERIVA              .163316-02       -.131854-01        .953595-02       -.120959-01
CONVERGENZA        -.289634-04        .643486-04        .139415-05       -.119087-03
CAMPANATURA         .102383-02        .172013-01        .465917-03       -.191336-01
CAMP. RIF. AL SUOLO-.280056-01        .291466-01       -.282778-01       -.413484-01
SCUOTIMENTO         .159455-01        .824063-01       -.415949-02        .624639-01
VELOCITA' SCUOTIM. -.101112          -.641213-01        .881358-01        .123596
VEL. DEF. LAT. PNEUM. .000000         .000000           .000000           .000000
CARICO  SCUOTIMENTO 4169.79           4187.54           3558.82           3395.48
  ''    LATERALE   -79.3647          638.234          -424.758           949.175
  ''    LONGITUDIN.  266.884         -48.7809           223.762          -71.6383
QUOTA PESO+CAR.SCUOT. 4634.19         4621.53           3968.36           3766.14
MOMENTO AUTOALLIN.  3.13852          -23.8960           13.1299          -15.5847
  ''    RES. AL ROTOL. 17.5641         17.4128           14.6944           13.8214
  ''    FRENANTE    .000000           .000000           .000000           .000000
VEL.CENTRO RUOTA    24.4179           24.4083           24.6328           24.6227
VEL.ROTAZ. RUOTA    81.3472           79.8383           81.9981           88.3286
SCORRIMENTO         .153574-01       -.235869-02        .158364-01       -.587245-02

                        $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    449.884    =    4288.44    GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.93768   CV
COPPIA                 34.6428    =    3.53130    KGM       * POTENZA AERODINAMICA   =  9.28663   CV
POTENZA                15557.2    =    21.1446    CV
FARFALLA               .310696
COPPIA VOLANTE        -.838351    *    RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA              3    *    RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000    *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.2000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.2852        RAGGIO EFFETTIVO      = -449.478   *
*   ACCELERAZIONE LATERALE  = -.136411   G    CONTINGENZA EFFETTIVA  = -.136393   *
*****************************************************************************

                          $$$$$ V E T C O L O $$$$$

X           =  29.3696          VINX   =  24.3322          AINX   =  .194975
Y           =  1.99214          VINY   =  3.85862          AINY   = -1.32484
Z           =  .378848-01       VINZ   =  .286937-02       AINZ   = -.185091-01
CURVATURA   = -.222482-02       VMORX  =  24.5155          AMORX  =  .21228A-01
VELOCITA'   =  24.8237          VMORY  = -.138933          AMORY  = -1.33919
RAGGIO      = -449.478          VMORZ  =  .617582          AMORZ  = -.288782-02
PASSO INT.  =  .200000-01       PSTAR  =  .238831          PPUNTOS= -.281927
CONTINGENZA= -.136393           QSTAR  = -.130768-01       QPUNTOS= -.284279
INDICE FSV  =  5.91781          RSTAR  = -.286418          RPUNTOS= -.486594

                     $$$$$ ANGOLI  VEICOLO $$$$$

            ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO   -.549878-02        -        *      0G-18P 52.5S          -
ASSETTO MIS.    .000000           -        *      0G  0P   .0S          -
IMBARDATA       .138938       -.206558     *      7G 28P 45.3S      -11G 5PP  5.5S     -.488428
BECCHEGGIO      .258332-01    -.118321-01  *      1G 26P  3.5S       0G-48P 48.5S
ROLLIO          .682539-02     .225661     *      9G 28P 42.8S      12G 55P 45.9S
VOLANTE        -.723758        .000000     *     -41G 28P  4.2S      0G  0P   .0S      .000000

                          $$$$$ R U O T E $$$$$

                    ANT.SIN.          POST.SIN.         ANT.DES.          POST.DES.
STERZO             -.310216-01        .000000          -.387966-01        .000000
DERIVA              .146993-01        .619441-02        .226648-01        .628568-02
CONVERGENZA         .110631-03        .937783-04        .456688-05       -.731573-04
CAMPANATURA         .188694-03        .186557-01       -.821748-03       -.177967-01
CAMP. RIF. AL SUOLO .257867-01        .351534-01        .255997-01       -.276635-01
SCUOTIMENTO         .192898-02        .688153-01        .186782-01        .774048-01
VELOCITA' SCUOTIM.  -.145782          -.175796           .181229           .148424
VEL. DEF. LAT. PNEUM. .000000         .000000           .000000           .000000
CARICO  SCUOTIMENTO  3254.32          3363.27           4366.48           4139.74
  ''    LATERALE    -605.775         -263.432          -1098.43          -384.776
  ''    LONGITUDIN.  234.730          -35.1248          249.372          -72.7675
QUOTA PESO+CAR.SCUOT. 3664.28         3725.98           4839.43           4561.87
MOMENTO AUTOALLIN.   16.4299          7.59121           42.2875           11.5671
  ''    RES. AL ROTOL. 13.3118        13.5729           18.6053           17.3376
  ''    FRENANTE      .000000         .000000           .000000           .000000
VEL.CENTRO RUOTA     24.3736          24.3742           24.6692           24.6718
VEL.ROTAZ. RUOTA     81.3022          79.7145           82.0005           80.5445
SCORRIMENTO          .178824-01      -.251386-02        .137411-01       -.425367-02

                        $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    449.187    =    4288.58    GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.86507    CV
COPPIA                 34.6385    =    3.53894    KGM       * POTENZA AERODINAMICA   =  9.29180    CV
POTENZA                15556.4    =    21.1436    CV
FARFALLA               .318696
COPPIA VOLANTE        -2.96676    *    RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA              3    *    RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000    *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.3000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.2000        RAGGIO EFFETTIVO      = -225.681   *
*   ACCELERAZIONE LATERALE  = -.271886   G    CONTINGENZA EFFETTIVA  = -.271762   *
*****************************************************************************

                              $$$$$ V E I C O L O $$$$$

X           =  31.8040          VINX   =  24.3575              AINX   =  .294131
Y           =  2.21900          VINY   =  2.85664              AINY   = -2.64976
Z           =  .382077-01       VINZ   =  .253859-02           AINZ   = -.887743-01
CURVATURA   = -.443261-02       VMORX  =  24.5171              ANORX  =  .813284-02
VELOCITA'   =  24.5245          VMORY  =  .223389              ANORY  = -2.66728
RAGGIO      = -225.681          VMORZ  =  .558219              ANORZ  = -.159463-01
PASSO INT.  =  .200000-01       PSTAR  =  .124824              PPUNTOS= -1.48645
CONTINGENZA= -.271762           QSTAR  = -.355874-01           QPUNTOS= -.198532
INDICE ESV  =  6.78378          RSTAR  = -.238958              RPUNTOS= -.192735

                        $$$$$ ANGOLI  VEICOLO $$$$$

          ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:       VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO    .855437-02        -        *    0G 29P 24.5S        -
ASSETTO MIS.    .000000           -        *    0G  0P   .0S        -
IMBARDATA       .108192       -.236813     *    6G 11P 56.2S    -13G 34P  8.2S     -.107349
BECCHEGGIO      .228752-01    -.298568-01  *    1G 18P 38.4S    -1G 42P 38.3S
ROLLIO          .242479-01     .119408     *    1G 23P 21.5S     6G 50P 29.4S
VOLANTE        -.723759        .000000     *   -41G 28P  4.2S     0G  0P   .0S      .000000

                          $$$$$ R U O T E $$$$$

                  ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO          -.318216-01       .000000        -.387966-01       .000000
DERIVA           .272464-01       .228522-01      .348992-01       .219481-01
CONVERGENZA      .243627-05       .135594-03      .178007-03      -.582422-04
CAMPANATURA     -.997122-03       .196153-01     -.994658-03      -.164405-01
CAMP. RTF. AL SUOLO .326379-01    .494676-01      .326449-01       .241687-01
SCUOTIMENTO     -.921786-02       .529705-01      .269446-01       .878579-01
VELOCITA' SCUOTIM.  -.488164-01   -.126787         .127932         .477843-01
VEL. DEF. LAT. PNEUM.  .000000    .000000         .000000         .000000
CARICO  SCUOTIMENTO  2815.35      2694.59         4946.68         4775.34
  ''     LATERALE   -968.937     -763.932        -1707.54        -1183.22
  ''     LONGITUDIN.  234.678     -28.4276         252.349         -72.9475
QUOTA PESO+CAR.SCUOT.  3181.96    3015.81         5463.65         5239.88
MOMENTO AUTOALLIN.    28.4845     15.4896         74.8238         47.5738
  ''     RES. AL ROTOL.  11.3088   10.6487         21.5515         28.4843
  ''     FRENANTE      .000000     .000000         .000000         .000000
VEL.CENTRO RUOTA       24.3499     24.3581         24.6774         24.6987
VEL.ROTAZ. RUOTA       81.4044     79.6358         81.9184         88.6524
SCORRIMENTO         .196674-01    -.251365-02      .123175-01      -.371385-02

                        $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.     449.138     =   4288.95   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.99268   CV
COPPIA                  34.6348     =   .53988   KGM       * POTENZA AERODINAMICA   =  9.20199   CV
POTENZA                 15555.4     =   21.1423   CV
FARFALLA                .318696
COPPIA VOLANTE         -4.84697     *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA             3       *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000      *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.4000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.2726        RAGGIO EFFETTIVO      = -166.753   *
*   ACCELERAZIONE LATERALE = -.367513   G     CONTINGENZA EFFETTIVA =  -.367539  *
*****************************************************************************
                              $$$$$ V E I C O L O $$$$$
X           =  34.2412          VINX   =  24.3881              AINX   =  .304928
Y           =  2.48978          VINY   =  2.54161              AINY   = -3.59348
Z           =  .379213-01       VINZ   = -.708864-02           AINZ   = -.241187-01
CURVATURA   = -.590689-02       VMORX  =  24.5187              AMORX  =  .383917-02
VELOCITA'   =  24.5282          VMORY  =  .588886              AMORY  = -3.60538
RAGGIO      = -166.753          VMORZ  =  .454698              AMORZ  =  .855669-01
PASSO INT.  =  .200000-01       PSTAR  =  .337355-01           PPUNTO$=  -.771788-01
CONTINGENZA=  -.367539          QSTAR  = -.483424-01           QPUNTO$=   .146269
INDICE FSV  =  7.29877          RSTAR  = -.258494              RPUNTO$=  -.189815

                              $$$$$ ANGOLI  VETCOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:          VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO     .281493-01        -        *     1G  9P 16.1S           -
ASSETTO MIS.     .000000           -        *     0G  0P   .0S          -
IMBARDATA        .836911-01     -.251652    *     4G 47P 42.5S       -14G 25P  6.9S     -.184539
BECCHEGGIO       .194586-01     -.327188-01 *     1G  6P 53.6S       -1G 52P 26.9S
ROLLIO           .383098-01      .288398-01 *     1G 44P 30.4S        1G 39P  8.5S
VOLANTE         -.723758         .000000    *    -41G 28P  4.2S       0G  0P   .0S      .000000

                              $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO             -.318216-01        .000000          -.387966-01        .000000
DERIVA              .381658-01        .345057-01        .454113-01        .342993-01
CONVERGENZA         .329844-03        .154173-03        .427227-03       -.587525-04
CAMPANATURA        -.185778-02        .198238-01       -.542526-03       -.165474-01
CAMP. RTF. AL SUOLO .352252-01        .538590-01        .356489-01        .238065-01
SCUOTIMENTO        -.864728-02        .434298-01        .354276-01        .671869-01
VELOCITA' SCUOTTM.  .129388-01       -.743697-01        .555664-01       -.319859-01
VEL. DEF. LAT. PNEUM. .000000         .000000          .000000          .000000
CARICO  SCUOTIMENTO 2738.82           2417.52          5287.68          4788.51
  ''    LATERALE   -1271.82          -1043.97         -2169.55         -1666.26
  ''    LONGITUDIN.  249.469          -25.2026          248.698          -67.8957
QUOTA PESO+CAR.SCUOT. 3872.94         2789.36          5836.27          5193.93
MOMENTO AUTOALLIN.  24.3168           17.1654          99.8271          67.3282
  ''    RES. AL ROTOL.  10.8684         9.42375          23.3626          20.2719
  ''    FRENANTE      .000000         .000000          .000000          .000000
VEL.CENTRO RUOTA    24.3116           24.3388          24.6697          24.6929
VEL.ROTAZ. RUOTA    81.4748           79.5726          81.8186          80.6787
SCORRIMENTO         .216486-01       -.248854-02       .113629-01       -.344329-02

                              $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    449.833     =    4287.95    GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.98422    CV
COPPIA                 34.6496     =    3.53287    KGM       * POTENZA AERODINAMICA   =  9.28712    CV
POTENZA                15558.8     =    21.1469    CV
FARFALLA               .318696
COPPIA VOLANTE        -6.35259     *    RISULTANTE FORZE EXT. PARTIC.      .000000
MARCIA INSERITA            3       *    RISULTANTE MOM. EXT. PARTIC.       .000000
PRESS.CIRC.FRENANTE    .000000     *    RISULTANTE COMP. VELOC. VENTO      .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.5000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.2365        RAGGIO EFFETTIVO      = -142.558    *
*   ACCELERAZIONE LATERALE  = -.429401   G    CONTINGENZA EFFETTIVA  =  -.429978   *
*****************************************************************************
                          $$$$$ V E I C O L O $$$$$
X           =  36.6815          VINX   =  24.4198              AINX   =  .248433
Y           =  2.72475          VINY   =  2.14916              AINY   = -4.28021
Z           =  .372973-01       VINZ   = -.439615-02           AINZ   =  .346417-01
CURVATURA   = -.781467-02       VMORX  =  24.4958              AMORX  = -.497642-02
VELOCITA'   =  24.5183          VMORY  =  .741877              AMORY  = -4.21943
RAGGIO      = -142.558          VMORZ  =  .397306              AMORZ  =  .178613
PASSO INT.  =  .200000-01       PSTAR  =  .512318-01           PPUNTOS= -.283245-01
CONTINGENZA= -.429578           QSTAR  = -.141861-01           QPUNTOS=  .298186
INDICE FSV  =  7.42881          RSTAR  = -.250691              RPUNTOS= -.431588-01

                      $$$$$ ANGOLI  VETCOLO $$$$$
          ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:       VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO     .297000-01        -          *     1G 42P  6.2S          -
ASSETTO MTS.     .000000           -          *     0G  0P   .0S          -
IMBARDATA        .500961-01    -.259854       *     3G 19P 43.2S    -14G 5HP 33.7S    -.399481-01
BECCHEGGIO       .174226-01    -.533884-02    *     0G 59P 53.7S      0G-18P 21.1S
ROLLIO           .341790-01     .467186-01    *     1G 57P 29.0S      2G 4PP 36.4S
VOLANTE         -.72375P        .000000       *    -41G 20P  4.2S      0G  0P   .0S     .000000

                          $$$$$ R U O T E $$$$$
                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO             -.310216-01        .000000          -.387966-01        .000000
DERIVA              .474134-01        .446000-01        .543138-01        .442030-01
CONVERGENZA         .516020-03        .160167-03        .630430-03       -.594250-04
CAMPANATURA        -.117118-02        .100125-01       -.120023-03       -.166576-01
CAMP. RTF. AL SUOLO .373309-01        .507314-01        .382503-01        .247090-01
SCUOTIMENTO        -.943636-02        .372105-01        .401073-01        .864180-01
VELOCITA' SCUOTIM. -.389651-01       -.454005-01        .360776-01        .210004-01
VEL. DEF. LAT. PNEUM. .000000         .000000           .000000           .000000
CARICO  SCUOTIMENTO 2506.53           2217.03           5629.27           4701.93
  ''    LATERALE   -1406.04          -1193.74          -2514.01          -2000.15
  ''    LONGITUDIN.  247.247          -22.1066          248.700           -63.0790
QUOTA PESO+CAR.SCUOT. 2019.31         2009.52           6100.61           5214.27
MOMENTO AUTOALLIN.   22.0346          16.6591          120.000           00.9159
  ''    RES. AL ROTOL. 0.84442        0.56020          25.1502           20.3027
  ''    FRENANTE    .000000           .000000          .000000           .000000
VEL.CENTRO RUOTA    24.2029           24.3003          24.6403           24.6010
VEL.ROTAZ. RUOTA    81.5226           79.5090          81.6914           00.6603
SCORRIMENTO         .233861-01       -.237761-02       .106005-01       -.322601-02

                       $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    448.839     =    4285.00    GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.90310   CV
COPPIA                 34.6705     =    3.53502    KGM       * POTENZA AERODINAMICA   =  9.27506   CV
POTENZA                15565.1     =    21.1554    CV
FARFALLA               .310606
COPPIA VOLANTE        -7.45050      *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA              3      *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CTRC.FRENANTE    .000000      *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.6000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.1841        RAGGIO EFFETTIVO      = -178.417   *
*   ACCELERAZIONE LATERALE  = -.343495   G    CONTINGENZA EFFETTIVA  =  -.342823  *
*****************************************************************************
                          $$$$$ V E I C O L O $$$$$
X           =  39.1241          VINX   =  24.4353              AINX   =  .169842
Y           =  2.91792          VINY   =  1.71778              AINY   = -3.35946
Z           =  .369546-01       VINZ   = -.758979-02           AINZ   = -.214719
CURVATURA   = -.560485-02       VHORX  =  24.4748              ANORX  =  .654653-01
VELOCITA'   =  24.4996          VHORY  =  .945553              ANORY  = -3.36881
RAGGIO      = -178.417          VHORZ  =  .483858              ANORZ  = -.881179-01
PASSO INT.  =  .200000-01       PSTAR  = -.175154-01           PPUNTOS= -3.59090
CONTINGENZA = -.342823          QSTAR  =  .979828-02           QPUNTOS=  .287494
INDICE FSV  =  585445.          RSTAR  = -.258435              RPUNTOS=  .815878

                        $$$$$ ANGOLI  VETCOLO $$$$$
          ANGOLI DI:      VELOCITA' DI:  *     ANGOLI DI:       VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO     .379691-01      -          *    26 18P 31.79       -
ASSETTO MTS.     .000000         -          *    00  0P   .05       -
IMBARDATA        .322113-01    -.249938     *    15 58P 44.13    -146 19P 13.45     .925899
BECCHEGGIO       .182367-01     .191133-01  *    16  2P 41.68     16  5P 42.45
ROLLIO           .372635-01    -.220732-01  *    26  8P  6.15    -16 15P 52.99
VOLANTE         -.102528-04     .216514-02  *    86  8P -2.15     86  7P 26.68    -10855.6

                          $$$$$ R U O T E $$$$$
                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO           -.439423-06      .000000        -.549558-06      .000000
DERIVA            .251584-01      .524699-01      .241302-01      .519285-01
CONVERGENZA       .196975-04      .160672-03      .668812-03     -.573842-04
CAMPANATURA      -.173863-02      .197027-01     -.486983-04     -.162294-01
CAMP. RIF. AL SUOLO .399387-01    .508077-01      .414411-01      .278391-01
SCUOTIMENTO      -.131254-01      .356042-01      .408742-01      .893324-01
VELOCITA' SCUOTIM.  -.150587-01   .346644-01     -.471242-01      .378755-02
VEL. DEF. LAT. PNEUM. .000000     .000000         .000000         .000000
CARICO  SCUOTIMENTO  2487.94      2162.37         5753.59         5034.16
  ''    LATERALE    -784.258     -1325.88        -1227.83        -2413.31
  ''    LONGITUDIN.  258.277      -23.4322        215.974         -88.4349
QUOTA PESO+CAR.SCUOT. 2787.93     2421.50         6337.47         5568.77
MOMENTO AUTOALLIN.   14.8353      17.1148         60.8497         89.6824
  ''    RES. AL ROTOL.  9.72391   8.38545         25.8658         22.8882
  ''    FRENANTE     .000000      .000000         .000000         .000000
VEL.CENTRO RUOTA     24.2917      24.2929         24.6547         24.6528
VEL.ROTAZ. RUOTA     81.5983      79.4435         81.5763         88.5946
SCORRIMENTO          .239392-01  -.258837-02      .998768-02     -.289811-02

                        $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.   448.738    =   4285.86   GIRI/1'   • POTENZA DI ROTOLAMENTO =  7.10382   CV
COPPIA                34.6947    =   3.53666  KGM       • POTENZA AERODINAMICA   =  9.25991   CV
POTENZA               15568.6    =   21.1681   CV
FARFALLA              .319696
COPPIA VOLANTE       -4.38299    •   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA            3     •   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE   .000000    •   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.7####             *
*                                                                           *
*****************************************************************************
*  VELOCITA' KM/H          =  8#.1529        RAGGIO EFFETTIVO      = -151.629  *
*  ACCELERAZIONE LATERALE  = -.4#2287  G     CONTINGENZA EFFETTIVA =  -.4#3184  *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$

X           =  41.56#4          VINX   =  24.45#1          AINX   =  .19879#
Y           =  3.#7148          VINY   =  1.34225          AINY   = -3.95377
Z           =  .361793-#1       VINZ   =  .237198-#2       AINZ   =  .216835
CURVATURA   = -.659584-#2       VMORX  =  24.45#6          AMORX  =  .788748-#1
VELOCITA'   =  24.4869          VMORY  =  1.#763#          AMORY  = -3.94644
RAGGIO      = -151.629          VMORZ  =  .477138          AMORZ  =  .338369
PASSO INT.  =  .2#####-#1       PSTAR  = -.15754#-#1       PPUNTOS=  1.63918
CONTINGENZA= -.4#3184           QSTAR  =  .214153-#1       QPUNTOS= -.715191-#2
INDICE ESV  = -.336926          RSTAR  = -.169155          #PUNTOS=  .695826

                      $$$$$ ANGOLI  VEICOLO $$$$$

              ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:       VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO     .433588-#1         -        *     2G 29P  3.4S          -
ASSETTO MIS.     .######            -        *     8G  7P 28.6S          -
IMBARDATA        .114#38-#1     -.16#463     *     #G 39P 28.7S     -9G 39P  8.#S      .695#3#
BECCHEGGIO       .287355-#1      .265426-#1  *     1G 11P 17.#S      1G 31P 14.#S
ROLLIO           .3#3743-#1     -.192478-#1  *     1G 44P 25.2S     -1G  6P 18.#S
VOLANTE          .######        .######      *      #P   .#S       #G  #P   .#S      .######

                          $$$$$ R U O T E $$$$$

                    ANT.SIN.        POST.STN.        ANT.DES.        POST.DES.
STERZO               .######          .######          .######          .######
DERIVA               .347553-#1       .53####-#1       .341122-#1       .527777-#1
CONVERGENZA          .14#28#-#4       .154#65-#3       .311396-#3      -.5#7212-#4
CAMPANATURA         -.155473-#2       .198224-#1      -.767729-#3      -.165418-#1
CAMP. RIF. AL SUOLO  .355#25-#1       .543###-#1       .361441-#1       .249266-#1
SCUOTIMENTO         -.119721-#1       .435#53-#1       .328598-#1       .872259-#1
VELOCITA' SCUOTIM.  -.156509-#1       .552140-#1      -.474825-#1       .248158-#1
VEL. DEF. LAT. PNEUM.  .######          .######          .######          .######
CARICO  SCUOTIMENTO  2638.79          2538.##          4977.51          4827.1#
  ''    LATERALE    -1126.15         -1566.87         -1479.##         -23#1.92
  ''    LONGITUDIN.   248.#26           -42.215#         244.995          -44.7#26
QUOTA PESO+CAR.SCUOT. 2956.96          2#87.99          5548.##          5134.99
MOMENTO AUTOALLIN.    2#.7954          24.5#32          74.5247          #7.5###
  ''    RES. AL ROTOL.  1#.4#29          9.#1261          21.#7#3          19.9432
  ''    FRENANTE        .######          .######          .######          .######
VEL.CENTRO RUOTA      24.33#9          24.339#          24.5838          24.5#25
VEL.ROTAZ. RUOTA      81.6255          79.4#2#          81.5643          #0.4111
SCORRIMENTO           .223677-#1      -.4##6#2-#2       .117#87-#1      -.232151-#2

                        $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    448.772    =   4285.45   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.76949   CV
COPPIA                 34.6884    =   3.53683   KGM       * POTENZA AERODINAMICA   =  9.24946   CV
POTENZA                15567.2    =   21.1583   CV
FARFALLA               .31#696
COPPIA VOLANTE        -4.3##93    *   RISULTANTE FORZE EXT. #ARIC.      .######
MARCIA INSERITA              3     *   RISULTANTE #OM. EXT. #ARIC.       .######
PRESS.CINC.FRENANTE    .######     *   RISULTANTE COMP. VELOC. VENTO     .######
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.0000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.1187        RAGGIO EFFETTIVO      = -158.275   *
*   ACCELERAZIONE LATERALE  = -.386598   G    CONTINGENZA EFFETTIVA  =  -.345478  *
*****************************************************************************

                              $$$$$ V E I C O L O $$$$$

X           =  44.9135          VINX   =  24.4589          AINX   =  .624303-01
Y           =  3.18506          VINY   =  .952831          AINY   = -3.78590
Z           =  .367778-01       VINZ   =  .371486-03       AINZ   = -.258430
CURVATURA   = -.631811-02       VMORX  =  24.4596          AMORX  =  .762480-01
VELOCITA'   =  24.4774          VMORY  =  1.02879          AMORY  = -3.79286
RAGGIO      = -158.275          VMORZ  =  .520418          AMORZ  = -.135315
PASSO INT.  =  .200000-01       PSTAR  =  .263272-02       PPUNTOS=  -1.03578
CONTINGENZA = -.385878          QSTAR  =  .411895-03       QPUNTOS=  -.360244
INDICE FSV  = -.212268          RSTAR  = -.186175          RPUNTOS=   .533654

                          $$$$$ ANGOLI  VEICOLO $$$$$

                ANGOLI DI:        VELOCITA' DI:  *        ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO      .418110-01          -            *     2G 28P 59.1S          -
ASSETTO MIS.      .000000             -            *     0G  0P   .0S          -
IMBARDATA        -.218689-02       -.186134        *     0G -7P 14.6S       -6G  4P 51.7S      .521947
BECCHEGGIO        .225044-01        .381942-02      *     1G 17P 48.4S       0G 13P  7.8S
ROLLIO            .321086-01        .234889-03      *     1G 59P 22.9S       0G  0P 48.4S
VOLANTE           .000000           .000000         *     0G  0P   .0S       0G  0P   .0S      .000000

                              $$$$$ R U O T E $$$$$

                    ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO               .000000           .000000           .000000           .000000
DERIVA               .355689-01        .478739-01        .350728-01        .469471-01
CONVERGENZA          .311767-04        .151888-03        .296554-03       -.568888-04
CAMPANATURA         -.284395-02        .198814-01       -.795342-03       -.158648-01
CAMP. RIF. AL SUOLO  .376866-01        .566112-01        .386118-01        .278278-01
SCUNTIMENTO         -.149641-01        .454782-01        .315718-01        .916746-01
VELOCITA' SCUNTIM.  -.566874-02        .516863-02       -.359861-02        .728771-02
VEL. DEF. LAT. PNEUM.  .000000         .000000           .000000           .000000
CARICO  SCUNTIMENTO  2558.78           2457.81           5186.46           5382.65
   ''     LATERALE  -1121.34          -1382.29          -1726.05          -2243.15
   ''     LONGITUDIN.  237.266         -42.8286           262.915          -59.9629
QUOTA PESO+CAR.SCUOT.  285..49         2738.81           5667.38           5887.84
MOMENTO AUTOALLIN.   10.9289           21.6938           78.8952           183.832
   ''     RES. AL ROTOL.  18.1121        9.54657           22.4651           23.5444
   ''     FRENANTE  .000000           .000000           .000000           .000000
VEL.CENTRO RUOTA     24.3788           24.3786           24.5324           24.5314
VEL.ROTAZ. RUOTA     81.7223           79.5965           81.4417           88.2125
SCORRIMENTO          .219577-01       -.417648-02        .123789-01       -.271578-02

                          $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    448.781     =    428.78    GIRI/1'    * POTENZA DI ROTOLAMENTO =  7.16283    CV
COPPIA                 34.6991     =    3.53711   KGM        * POTENZA AERODINAMICA   =  9.23863    CV
POTENZA                15569.5     =    21.1514   CV
FARFALLA               .318696
COPPIA VOLANTE        -4.44948     *    RISULTANTE FORZE EST. BARIC.       .000000
MARCIA INSERITA             3      *    RISULTANTE MOM. EST. BARIC.        .000000
PRESS.CIRC.FRENANTE    .000000     *    RISULTANTE COMP. VELOC. VENTO      .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    1.0000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.8952        RAGGIO EFFETTIVO      = -181.276   *
*   ACCELERAZIONE LATERALE  = -.336122   G    CONTINGENZA EFFETTIVA  = -.336736   *
*****************************************************************************
                              $$$$$ V E I C O L O $$$$$
X           =  46.4691          VINX   =  24.4637              AINX   =  .308734-01
Y           =  3.26292          VINY   =  .599275              AINY   = -3.38339
Z           =  .369500-01       VINZ   = -.688395-02           AINZ   =  .139213
CURVATURA   = -.551644-02       VMORX  =  24.4586              AMORX  =  .711284-01
VELOCITA'   =  24.4789          VMORY  =  .863602              AMORY  = -3.29736
RAGGIO      = -181.276          VMORZ  =  .499973              AMORZ  =  .235078
PASSO INT.  =  .200000-01       PSTAR  = -.362445-01           PPUNTOS=  .286995
CONTINGENZA = -.336736          QSTAR  = -.183588-01           QPUNTOS=  .398465-01
INDICE FSV  = -.124538          RSTAR  = -.617508-01           RPUNTOS=  .339025

                          $$$$$ ANGOLI  VETCOLO $$$$$
              ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO     .347824-01         -        *    16 52P 17.98           -
ASSETTO MIS.     .000000            -        *    00  0P   .00          -
IMBARDATA       -.183742-01     -.622698-01   *    06-35P 39.89      -36 34P  3.95      .340001
BECCHEGGIO       .215732-01     -.165696-01   *    16 14P  9.85       06-56P 57.75
ROLLIO           .208429-01     -.375877-01   *    16 39P  9.39      -26  0P 13.89
VOLANTE          .000000         .000000      *    00  0P   .00       00  0P   .00      .000000

                              $$$$$ R U O T E $$$$$
                        ANT.SIN.          POST.SIN.         ANT.DES.          POST.DES.
STERZO                   .000000           .000000           .000000           .000000
DERIVA                   .315007-01        .301844-01        .311531-01        .302534-01
CONVERGENZA              .143751-04        .150692-03        .245592-03       -.507627-04
CAMPANATURA             -.156689-02        .197088-01       -.886648-03       -.165492-01
CAMP. RTF. AL SUOLO      .347747-01        .532088-01        .353106-01        .248308-01
SCUOTIMENTO             -.120496-01        .496613-01        .297637-01        .871748-01
VELOCITA' SCUOTIM.       .411839-01       -.382008-02       -.133789-01       -.571986-01
VEL. DEF. LAT. PNEUM.    .000000           .000000           .000000           .000000
CARICO  SCUOTIMENTO     2777.23           2544.20           4954.42           4617.78
   "    LATERALE       -1082.95          -1105.98          -1543.59          -1825.48
   "    LONGITUDIN.      250.637           -42.8671          252.414           -96.4836
QUOTA PESO+CAR.SCUOT.   3112.14           2836.93           5582.14           5189.73
MOMENTO AUTOALLIN.        21.7672           20.5341           68.5848           70.7997
   "    RES. AL ROTOL.    11.8433            9.94328          21.6584           19.7888
   "    FRENANTE          .000000           .000000           .000000           .000000
VEL.CENTRO RUOTA         24.4198           24.4184           24.5007           24.5000
VEL.ROTAZ. RUOTA         81.7892           79.7116           81.3249           80.0015
SCORRIMENTO               .214760-01       -.482044-02        .122335-01       -.204350-02

                          $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.     448.564     =    4283.47    GIRI/1'    * POTENZA DI ROTOLAMENTO =  6.00734    CV
COPPIA                   34.7105    =    3.31016    KGM        * POTENZA AERODINAMICA   =  9.23194    CV
POTENZA                  1557.9     =    21.1674    CV
FARFALLA                 .319606
COPPIA VOLANTE          -4.11081    *    RISULTANTE FORZE EXT. RAPIC.      .000000
MARCIA INSERITA              3       *    RISULTANTE MOM. EXT. RAPIC.       .000000
PRESS.CIRC.FRENANTE      .000000     *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.0000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  60.0001        RAGGIO EFFETTIVO      = -223.244   *
*   ACCELERAZIONE LATERALE = -.272918   G     CONTINGENZA EFFETTIVA =  -.273389  *
*****************************************************************************
                              $$$$$ V E I C O L O $$$$$
X           =  48.9866          VINX   =  24.4671              AINX   =  .318794-01
Y           =  3.30695          VINY   =  .295711              AINY   = -9.68175
Z           =  .361348-01       VINZ   =  .773812-02           AINZ   =  .184771
CURVATURA   = -.447940-02       VMORX  =  24.4547              AMORX  =  .782862-01
VELOCITA'   =  24.4689          VMORY  =  .677788              AMORY  = -2.47732
RAGGIO      = -223.244          VMORZ  =  .487578              AMORZ  =  .175585
PASSO INT.  =  .200000-01       PSTAR  = -.330586-01           PPUNTO$=  -.288748
CONTINGENZA= -.273389           QSTAR  = -.784148-02           QPUNTO$=  .118540
INDICE FSV  = -.680687-01       RSTAR  = -.338359-01           RPUNTO$=  .221638

                          $$$$$ ANGOLI  VETCOLO $$$$$
            ANGOLI DI$       VELOCITA' DI$   *      ANGOLI DI$       VELOCITA' DI$   ACCELERAZIONI DI$
ASSETTO VERO    .271788-01          -        *    1G 33P 26.85          -
ASSETTO MIS.    .000000             -        *    0G  0P   .00          -
IMBARDATA      -.150933-01      -.340343-01  *   0G-51P 53.25    -1G 57P   .15     .224675
BECCHEGGIO      .293287-01      -.696398-02  *    1G  9P 53.15    0G-23P 56.48
ROLLIO          .258594-01      -.337424-01  *    1G 28P 53.95    -1G 55P 59.95
VOLANTE         .000000          .000000     *    0G  0P   .00    0G  0P   .00     .000000

                              $$$$$ R U O T E $$$$$
                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STEPZO              .000000          .000000         .000000          .000000
DERIVA              .254279-01       .290871-01      .251467-01       .291615-01
CONVERGENZA         .248774-05       .149867-03      .232314-03      -.629642-04
CAMPANATURA        -.100823-02       .197017-01     -.989299-03      -.178757-01
CAMP. RTF. AL SUOLO .321112-01       .499713-01      .321819-01       .221464-01
SCUOTIMENTO        -.824585-02       .461395-01      .292531-01       .833683-01
VELOCITA' SCUOTIM.  .408268-01       .219898-01     -.774586-02      -.262338-01
VEL. DEF. LAT. PNEUM. .000000        .000000         .000000          .000000
CARICO  SCUOTIMENTO 2958.87          2664.70         4898.23          4432.16
  "     LATERALE    -938.131         -976.534        -1261.81         -1488.83
  "     LONGITUDIN.  257.019          -42.6851        243.187          -56.8119
QUOTA PESO+CAR.SCUOT. 3304.92        2975.24         5426.93          4906.86
MOMENTO AUTOALLIN.  21.8553          18.7848         56.4548          53.6387
  "     RES. AL ROTOL. 11.8350       10.4091         21.2818          18.8376
  "     FRENANTE    .000000          .000000         .000000          .000000
VEL.CENTRO RUOTA    24.4347          24.4349         24.4843          24.4839
VEL.ROTAZ. RUOTA    81.8103          79.8886         81.2473          80.0273
SCORRIMENTO         .207383-01      -.381864-02      .119406-01      -.388748-02

                            $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.   448.489    =   4281.00   GIRT/1'   * POTENZA DI ROTOLAMENTO =  6.80902   CV
COPPIA                34.7427    =   3.54156   KGM       * POTENZA AERODINAMICA   =  9.22982   CV
POTENZA               15578.9    =   21.1742   CV
FARFALLA              .319696
COPPIA VOLANTE       -3.54845    *   RISULTANTE FORZE EXT. RAPIP.      .000000
MARCIA INSERITA             3    *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE   .000000    *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.1000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.8934        RAGGIO EFFETTIVO      = -292.232   *
*   ACCELERAZIONE LATERALE  = -.208754   G    CONTINGENZA EFFETTIVA  = -.208874   *
*****************************************************************************
                              $$$$$ V E I C O L O $$$$$
X           =  51.3535          VINX   =  24.4783              AINX   =  .334159-01
Y           =  3.32417          VINY   =  .892387-01           AINY   = -2.84898
Z           =  .372289-01       VINZ   =  .121641-01           AINZ   = -.129536-01
CURVATURA   = -.342104-02       VMORX  =  24.4693              AMORX  =  .894072-01
VELOCITA'   =  24.4784          VMORY  =  .497634              AMORY  = -2.84788
RAGGIO      = -292.232          VMORZ  =  .493684              AMORZ  =  .318885-01
PASSO INT.  =  .200000-01       PSTAR  = -.644871-01           PPUNTOS= -.166781
CONTINGENZA = -.208874          QSTAR  =  .985254-03           QPUNTOS=  .512763-01
INDICE FSV  = -.384722-01       RSTAR  = -.152568-01           RPUNTOS=  .146824

                              $$$$$ ANGOLI  VEICOLO $$$$$
              ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO     .199131-01        -          *    1G  8P 27.49          -
ASSETTO MIS.     .000000           -          *    0G  0P   .00          -
IMBARDATA       -.174926-01     -.152381-01   *   -1G  8P  8.15       8G-52P 92.75      .147099
BECCHEGGIO       .201921-01      .130266-02   *    1G  9P  6.49       0G  4P 28.75
ROLLIO           .208195-01     -.647133-01   *    1G 11P 34.35      -3G 42P 28.15
VOLANTE          .000000         .000000      *    0G  0P   .00       0G  0P   .00      .000000

                              $$$$$ R U O T E $$$$$
                        ANT.SIN.          POST.SIN.          ANT.DES.          POST.DES.
STERZO                   .000000           .000000           .000000           .000000
DERIVA                   .191275-01        .206553-01        .189381-01        .208451-01
CONVERGENZA             -.130445-05        .141135-03        .178763-03       -.573090-04
CAMPANATURA             -.354168-03        .196049-01       -.993691-03       -.174387-01
CAMP. RIF. AL SUOLO      .206857-01        .452253-01        .202338-01        .223861-01
SCUOTIMENTO             -.322488-02        .305465-01        .269755-01        .885289-01
VELOCITA' SCUOTIM.       .572489-01        .693374-01       -.364878-01       -.322953-01
VEL. DEF. LAT. PNEUM.    .000000           .000000           .000000           .000000
CARICO  SCUOTIMENTO     3219.67           2929.43           4665.15           4313.19
  "     LATERALE       -768.073          -771.119          -949.467          -1013.59
  "     LONGITUDIN.     265.895          -44.5018           231.668          -57.3874
QUOTA PESO+CAR.SCUOT.   3593.46           3258.34           5174.17           4769.19
MOMENTO AUTOALLIN.        19.8822           17.3671           48.7388           38.4575
  "     RES. AL ROTOL.    13.8384           11.6494           29.8708           18.2819
  "     FRENANTE          .000000           .000000           .000000           .000000
VEL.CENTRO RUOTA         24.4543           24.4544           24.4765           24.4763
VEL.ROTAZ. RUOTA         81.7918           79.8858           81.2287           79.9931
SCORRIMENTO              .197318-01       -.364039-02        .119307-01       -.328431-02

                              $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.     448.284     =    4282.80    GIRI/1'   * POTENZA DI ROTOLAMENTO *  5.86658   CV
COPPIA                  34.7613     =    3.54345    KGM       * POTENZA AERODINAMICA   *  0.23966   CV
POTENZA                 15582.9     =    21.1797    CV
FARFALLA                .310696
COPPIA VOLANTE         -2.81100     *    RISULTANTE  ORZE EXT. BARIC.      .000000
MARCIA INSERITA             3       *    RISULTANTE MOM. EXT. BARIC.      .000000
PRESS.CIRC.FRENANTE     .000000     *    RISULTANTE COMP. VELOC. VENTO    .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.2000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  68.1074        RAGGIO EFFETTIVO      = -413.179   *
*   ACCELERAZIONE LATERALE  = -.147833   G    CONTINGENZA EFFETTIVA  = -.147779   *
*****************************************************************************

                              $$$$$ V E I C O L O $$$$$

X           =  53.8007          VINX   =  24.4748          AINX   =  .483814-01
Y           =  3.32087          VINY   = -.115293          AINY   = -1.44091
Z           =  .381907-01       VINZ   =  .551566-02       AINZ   = -.184891
CURVATURA   = -.242026-02       VMORX  =  24.4568          AMORX  =  .69855E-01
VELOCITA'   =  24.4743          VMORY  =  .341814          AMORY  = -1.45824
RAGGIO      = -413.179          VMORZ  =  .500291          AMORZ  = -.821871-01
PASSO INT.  =  .200000-01       PSTAR  = -.619945-01       PPUNTOS=  .189864
CONTINGENZA = -.147779          QSTAR  =  .418156-02       QPUNTOS=  .148968-01
INDICE FSV  = -.724492-02       RSTAR  = -.368149-02       RPUNTOS=  .831639-01

                         $$$$$ ANGOLI  VEICOLO $$$$$

            ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:          VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO     .136751-01        -        *    0G 47P  .7S             -
ASSETTO MTS.     .000000           -        *    0G  0P  .0S             -
IMBARDATA       -.183821-01    -.362246-02  *   -1G  3P 11.6S        0G-12P 27.2S      .833845-01
BECCHEGGIO       .284877-01     .423344-02  *    1G 10P  9.4S        0G 14P 33.2S
ROLLIO           .142978-01    -.611685-01  *    0G 48P 50.6S       -3G 39P 16.9S
VOLANTE          .000000        .000000     *    0G  0P  .0S        0G  0P  .0S      .000000

                         $$$$$ R U O T E $$$$$

                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO              .000000         .000000          .000000         .000000
DERIVA              .134847-01      .137497-01       .133818-01      .139568-01
CONVERGENZA         .121583-03      .126385-03       .101946-03     -.738259-04
CAMPANATURA         .288126-03      .194598-01      -.107874-02     -.178332-01
CAMP. RIF. AL SUOLO .249851-01      .393683-01       .242659-01     -.287286-01
SCUOTIMENTO         .213868-02      .567042-01       .227531-01      .771589-01
VELOCITA' SCUOTIM.  .445472-01      .555488-01      -.442396-01     -.325483-01
VEL. DEF. LAT. PNEUM. .000000       .000000          .000000         .000000
CARICO  SCUOTIMENTO 3495.48         3229.39          4431.01         4131.82
  ''    LATERALE   -581.046       -550.798         -654.469        -672.384
  ''    LONGITUDIN.  268.549       -46.9685         226.558         -56.2873
QUOTA PESO+CAR.SCUOT. 3988.27       3556.13          4921.05         4570.09
MOMENTO ANTIBALLIN.  17.1744        14.5426          27.1928         24.7688
  ''    RES. AL ROTOL.  14.2946     12.8863          18.8992         17.2967
  ''    FRENANTE      .000000       .000000          .000000         .000000
VEL.CENTRO RUOTA    24.4693         24.4694          24.4746         24.4746
VEL.ROTAZ. RUOTA    81.7325         79.9449          81.2421         79.9813
SCORRIMENTO         .184177-01     -.352147-02       .122765-01     -.327978-02

                        $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.   446.188     =   4279.81   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.91211   CV
COPPIA                34.7769     =   3.56504   KGM       * POTENZA AERODINAMICA   =  9.23595   CV
POTENZA               15586.3     =   21.1842   CV
FARFALLA              .310696
COPPIA VOLANTE       -2.88618     *   RISULTANTE FORZE ANT. RADIC.      .000000
MARCIA INSERITA           3       *   RISULTANTE MOM. ANT. RADIC.       .000000
PRESS.CIRC.FRENANTE   .000000     *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.3000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.1259        RAGGIO EFFETTIVO      = -631.712    *
*   ACCELERAZIONE LATERALE  = -.967409-01G    CONTINGENZA EFFETTIVA =  -.966073-01*
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$

X          =  56.2483          VINX   =  24.4783          AINX   =  .455282-01
Y          =  3.30299          VINY   = -.234130          AINY   = -.949080
Z          =  .381708-01       VINZ   = -.590869-02       AINZ   = -.198821
CURVATURA  = -.158300-02       VMORX  =  24.4733          AMORX  =  .652367-01
VELOCITA'  =  24.4704          VMORY  =  .221065          AMORY  = -.940928
RAGGIO     = -631.712          VMORZ  =  .502609          AMORZ  = -.987491-01
PASSO INT. =  .200000-01       PSTAR  = -.398117-01       PPUNTOS=  .166128
CONTINGENZA= -.966973-01       QSTAR  =  .463445-02       QPUNTOS= -.434389-02
INDICE FSV =  .474439-02       RSTAR  =  .232928-02       RPUNTOS=  .376449-01

                       $$$$$ ANGOLI  VEICOLO $$$$$

              ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO      .884181-02        -        *     0G 30P 23.8$          -
ASSETTO MIS.      .000000           -        *     0G  0P   .0$         -
IMBARDATA        -.184062-01     .237219-02  *    -1G  3P 16.6$       0G  8P  9.3$     .376116-01
BECCHEGGIO        .208650-01     .461285-02  *     1G 11P 43.7$       0G 15P 51.5$
ROLLIO            .918689-02    -.397622-01  *     0G 31P 34.9$      -2G 16P 41.6$
VOLANTE           .000000        .000000     *     0G  0P   .0$       0G  0P   .0$     .000000

                          $$$$$ R U O T E $$$$$

                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO              .000000         .000000          .000000         .000000
DERIVA              .896134-02      .859297-02       .991454-02      .878873-02
CONVERGENZA         .202199-05      .115834-03       .588764-04     -.884289-04
CAMPANATURA         .466961-03      .192296-01      -.187286-02     -.181532-01
CAMP. RIF. AL SUOLO .229899-01      .352530-01       .223876-01     -.227115-01
SCUOTIMENTO         .518038-02      .609469-01       .185115-01      .741721-01
VELOCITA' SCUOTIM.  .171941-01      .293214-01      -.487795-01     -.281958-01
VEL. DEF. LAT. PNEUM. .000000       .000000          .000000         .000000
CARICO  SCUOTIMENTO 3668.92         3378.97          4253.87         3982.89
  ''    LATERALE   -401.893        -365.835         -436.868        -417.441
  ''    LONGITUDIN.  262.718        -48.1228         225.731         -54.9928
QUOTA PESO+CAR.SCUOT. 4969.17       3741.05          4726.79         4485.68
MOMENTO AUTOALLIN.  12.8671         18.4877          17.2228         14.9416
  ''    RES. AL ROTOL. 15.0881      13.6695          18.0885         16.5689
  ''    FRENANTE    .000000         .000000          .000000         .000000
VEL.CENTRO RUOTA    24.4882         24.4882          24.4768         24.4768
VEL.ROTAZ. RUOTA    81.6689         79.9876          81.2869         79.9846
SCORRIMENTO         .172153-01     -.343926-02       .127349-01     -.332860-02

                        $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    448.129    =   4279.31   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.90724   CV
COPPIA                 34.7846    =   3.54583   KGM       * POTENZA AERODINAMICA   =  9.24403   CV
POTENZA                15588.0    =   21.1865   CV
FARFALLA               .318696
COPPIA VOLANTE        -1.42795    *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA            3      *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000    *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.4000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.1460        RAGGIO EFFETTIVO      =  INFINITO   *
*   ACCELERAZIONE LATERALE  = -.590593-01G    CONTINGENZA EFFETTIVA =   .000000   *
*****************************************************************************

                              $$$$$ V E I C O L O $$$$$

X           =  58.5963          VINX   =  24.4831          AINX   =  .493329-01
Y           =  3.27558          VINY   = -.309499          AINY   = -.588055
Z           =  .379963-01       VINZ   = -.145624-01       AINZ   = -.543373-01
CURVATURA   = -.966422-03       VMORX  =  24.4794          ANORX  =  .609256-01
VELOCITA'   =  24.4850          VMORY  =  .134927          ANORY  = -.579372
RAGGIO      = -1034.75          VMORZ  =  .595646          ANORZ  = -.496648-01
PASSO INT.  =  .200000-01       PSTAR  = -.288760-01       PPUNTOS=  .644262-01
CONTINGENZA= -.590606-01        QSTAR  =  .350925-02       QPUNTOS= -.161315-01
INDICE FSV  =  .938868-02       RSTAR  =  .457283-02       RPUNTOS=  .109684-01

                        $$$$$ ANGOLI  VEICOLO $$$$$

              ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:        VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO     .538987-02          -       *     0G 18P 31.7S          -
ASSETTO MIS.     .000000             -       *     0G  0P   .0S          -
IMBARDATA       -.180304-01      .469434-02  *    -1G  1P 59.0S       0G 16P  8.3S     .108763-01
BECCHEGGIO       .212797-01      .348186-02  *     1G 13P  9.2S       0G 11P 58.2S
ROLLIO           .584952-02     -.287761-01  *     0G 2P   6.6S      -1G 3P  55.5S
VOLANTE          .000000         .000000     *     0G  0P   .0S       0G  0P   .0S     .000000

                              $$$$$ R U O T E $$$$$

                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO               .000000          .000000          .000000          .000000
DERIVA               .563097-02       .591198-02       .561447-02       .521858-02
CONVERGENZA          .185157-05       .189838-03       .199189-04      -.874386-04
CAMPANATURA          .529360-03       .191670-01      -.981864-03      -.184357-01
CAMP. RIF. AL SUOLO  .222149-01       .327975-01       .218205-01      -.247243-01
SCUORIMENTO          .600272-02       .628591-01       .144908-01       .712812-01
VELOCITA' SCUORIM.   .198386-02       .111452-01      -.398758-01      -.383881-01
VEL. DEF. LAT. PNEUM. .000000         .000000          .000000          .000000
CARICO  SCUORIMENTO  3749.89          3469.38          4187.91          3863.89
  ''    LATERALE    -257.866         -218.323         -271.881         -243.748
  ''    LONGITUDIN.  256.073         -48.6157         226.347          -53.7967
QUOTA PESO+CAR.SCUOT. 4172.52         3844.67          4569.22          4275.25
MOMENTO AUTOALLIN.   8.65758          6.59752          10.3493          8.58143
  ''    RES. AL ROTOL. 15.5342         14.1138          17.2958          15.9838
  ''    FRENANTE     .000000          .000000          .000000          .000000
VEL.CENTRO RUOTA     24.4881          24.4881          24.4813          24.4813
VEL.ROTAZ. RUOTA     81.6246          80.8180          81.3418          79.9972
SCORRIMENTO          .163657-01      -.337190-02       .132809-01      -.335555-02

                          $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    448.155    =   4279.57   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.86613   CV
COPPIA                 34.7886    =   3.54542   KGM       * POTENZA AERODINAMICA   =  9.24723   CV
POTENZA                15587.1    =   21.1453   CV
FARFALLA               .319696
COPPIA VOLANTE        -.987299    *   RISULTANTE FORZE EXT. PARIC.      .000000
MARCIA INSERITA              3     *   RISULTANTE MOM. EXT. PARIC.       .000000
PRESS.CIRC.FRENANTE    .000000     *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
                    RISULTATI ALL' ISTANTE  T    =    2.5000

   VELOCITA' KM/H          =  88.1665        RAGGIO EFFETTIVO      =  INFINITO
   ACCELERAZIONE LATERALE  = -.335685-016    CONTINGENZA EFFETTIVA =  .000000

                          $$$$$ V E I C O L O $$$$$

X          =  61.1449          VINX   =  24.4881          AINX   =  .525354-01
Y          =  3.24211          VINY   = -.354134          AINY   = -.338326
Z          =  .354799-01       VINZ   = -.166213-01       AINZ   =  .124704-01
CURVATURA  = -.549498-03       VMOBX  =  24.4853          AMOBX  =  .588364-01
VELOCITA'  =  24.4987          VMOBY  =  .769355-01       AMOBY  = -.329307
RAGGIO     = -1820.14          VMOBZ  =  .518674          AMOBZ  =  .148119-01
PASSO INT. =  .200000-01       PSTAR  = -.219309-01       PPUNTOS=  .788697-01
CONTINGENZA= -.335915-01       QSTAR  =  .188885-02       QPUNTOS= -.147783-01
INDICE FSV =  .100654-01       RSTAR  =  .582561-02       RPUNTOS= -.237884-02

                       $$$$$ ANGOLI  VEICOLO $$$$$

            ANGOLI DI:      VELOCITA' DI:    *    ANGOLI DI:       VELOCITA' DI:    ACCELERAZIONI DI:
ASSETTO VERO     .387262-02        -          *     RG 18P 33.83        -
ASSETTO MIS.     .000000           -          *     RG  8P   .83        -
IMBARDATA       -.175329-01      .503270-02   *    -1G  8P 16.48     RG 17P 18.1S    -.242828-02
BECCHEGGIO       .215423-01      .178423-02   *     1G 14P  3.48     RG  6P  8.8S
ROLLIO           .338439-02     -.218315-01   *     RG 11P 21.68    -1G 15P  3.1S
VOLANTE          .000000         .000000      *     RG  8P   .83     RG  8P   .83     .000000

                          $$$$$ R U O T E $$$$$

                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO               .000000         .000000          .000000         .000000
DERIVA               .333193-02      .267692-02       .333818-02      .288136-02
CONVERGENZA          .188464-03      .188232-03       .463214-03     -.953985-04
CAMPANATURA          .521792-03      .198683-01      -.823828-03     -.187873-01
CAMP. RTF. AL SUOLO  .219793-01      .319585-01       .218858-01     -.264836-01
SCUNTIMENTO          .598866-02      .634458-01       .186952-01      .682833-01
VELOCITA' SCUNTIN.  -.298856-02      .168848-02      -.347873-01     -.298583-01
VEL. DEF. LAT. PNEUM.  .000000       .000000          .000000         .000000
CARICO  SCUNTIMENTO   3818.59         3528.89          3994.82         3755.58
  ''    LATERALE     -153.931        -118.154         -158.514        -132.599
  ''    LONGITUDIN.   251.153         -49.8898         227.982         -52.4838
QUOTA PESO+CAR.SCUNT.  4241.82        3918.45          4445.19         4158.65
MOMENTO AUTOALLIN.     5.35298        3.69865          5.87833         4.49825
  ''    RES. AL ROTOL.  15.8376        14.3981          16.7411         15.4731
  ''    FRENANTE      .000000         .000000          .000000         .000000
VEL.CENTRO RUOTA       24.4943         24.4942          24.4869         24.4878
VEL.ROTAZ. RUOTA       81.5976         88.8486          81.3983         88.8158
SCORRIMENTO          .157919-01     -.334214-02       .136766-01     -.336558-02

                        $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    448.239    *    4288.37   GIRI/1'    * POTENZA DI ROTOLAMENTO =  6.8158   CV
COPPIA                 34.7681    *    3.54415   KGM          POTENZA AERODINAMICA   =  9.2536   CV
POTENZA                15584.4    *    21.1817   CV
FARFALLA               .319695
COPPIA VOLANTE        -.538085    *    RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA              3     *    RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000     *    RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.6000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  88.1873        RAGGIO EFFETTIVO      =  INFINITO   *
*   ACCELERAZIONE LATERALE  = -.174084-016    CONTINGENZA EFFETTIVA =   .000000   *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$

X           =  63.5940          VINX   =  24.4935              AINX   =  .552361-01
Y           =  3.20534          VINY   = -.378601              AINY   = -.171756
Z           =  .339606-01       VINZ   = -.128309-01           AINZ   =  .565246-01
CURVATURA   = -.284266-03       VMORX  =  24.4918              AMORX  =  .569198-01
VELOCITA'   =  24.4965          VMORY  =  .399623-01           AMORY  = -.178698
RAGGIO      = -3511.66          VMORZ  =  .517706              AMORZ  =  .580396-01
PASSO INT.  =  .200000-01       PSTAR  = -.126671-01           PPUNTOS=  .883523-01
CONTINGENZA= -.174191-01        QSTAR  =  .881613-03           QPUNTOS= -.341749-02
INDICE FSV  =  .890157-02       RSTAR  =  .444848-02           RPUNTOS= -.798461-02

                       $$$$$ ANGOLI  VEICOLO $$$$$

          ANGOLI DI:      VELOCITA' DI:  *      ANGOLI DI:       VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO     .159824-02        -        *    0G  5P 29.7S         -
ASSETTO MIS.     .000000           -        *    0G  0P   .0S         -
IMBARDATA       -.170548-01     .445878-02  *   0G-58P 37.6S      0G 15P 18.8S    -.799185-02
BECCHEGGIO       .216622-01     .794616-03  *   1G 14P 28.1S      0G  2P 43.9S
ROLLIO           .157279-02    -.125787-01  *    0G  5P 24.4S     0G-43P 12.9S
VOLANTE          .000000        .000000     *    0G  0P   .0S     0G  0P   .0S     .000000

                          $$$$$ R U O T E $$$$$

                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO               .000000          .000000         .000000          .000000
DERIVA               .182757-02       .123561-02      .183858-02       .144670-02
CONVERGENZA          .198284-05       .108491-03     -.645661-06      -.102328-03
CAMPANATURA          .491281-03       .198748-01     -.552983-03      -.189124-01
CAMP. RTF. AL SUOLO  .217681-01       .299268-01      .216823-01      -.277485-01
SCUOTIMENTO          .549488-02       .633581-01      .777664-02       .656153-01
VELOCITA' SCUOTIM.  -.479152-02      -.261897-02     -.238685-01      -.288438-01
VEL. DEF. LAT. PNEUM.  .000000         .000000         .000000          .000000
CARICO  SCUOTIMENTO  3848.74          3565.91         3938.49          3675.22
   ''     LATERALE  -85.9248         -54.9688        -85.3574         -65.6987
   ''     LONGITUDIN.  247.435        -49.3709         238.858         -51.4257
QUOTA PESO+CAR.SCUOT.  4284.11        3952.52         4375.26          4073.86
MOMENTO AUTOALLIN.  3.01788           1.75286         3.15358          2.18882
   ''     RES. AL ROTOL.  16.0297      14.5812         16.4316          15.1815
   ''     FRENANTE  .000000            .000000         .000000          .000000
VEL.CENTRO RUOTA     24.4997          24.4997         24.4932          24.4932
VEL.ROTAZ. RUOTA     81.5833          80.8592         81.4517          80.8353
SCORRIMENTO          .154017-01      -.333893-02      .149785-01      -.336689-02

                       $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.    448.346     =    4281.30   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.78375   CV
COPPIA                 34.7529     =    3.54251   KGM       * POTENZA AERODINAMICA   =  9.26822   CV
POTENZA                15588.9     =    21.1769   CV
FARFALLA               .319696
COPPIA VOLANTE        -.296896     *    RISULTANTE FORZE EXT. RAPIC.      .000000
MARCIA INSERITA              3     *    RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000     *    RISULTANTE COMP. VELOC. VENTO     .000000
```

RISULTATI ALL' ISTANTE T = 2.7000

VELOCITA' KM/H	= 88.2002	RAGGIO EFFETTIVO	= INFINITO
ACCELERAZIONE LATERALE	= -.772006-026	CONTINGENZA EFFETTIVA	= .000000

$$$$$ V E I C O L O $$$$$

X	= 66.8436	VINX	= 24.4902	AINX	= .571486-01
Y	= 3.16600	VINY	= -.398596	AINY	= -.767480-01
Z	= .330126-01	VINZ	= -.681376-02	AINZ	= .734202-01
CURVATURA	= -.126303-03	VMORX	= 24.4966	AMORX	= .560963-01
VELOCITA'	= 24.5023	VMORY	= .178020-01	AMORY	= -.757338-01
RAGGIO	= -7917.40	VMORZ	= .526741	AMORZ	= .747338-01
PASSO INT.	= .200000-01	PSTAR	= -.594363-02	PPUNTOS	= .383096-01
CONTINGENZA	= -.772959-02	QSTAR	= .100823-02	QPUNTOS	= .989947-02
INDICE ESV	= .707416-02	RSTAR	= .353549-02	RPUNTOS	= -.934602-02

$$$$$ ANGOLI VEICOLO $$$$$

	ANGOLI DI:	VELOCITA' DI:		ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	.711679-03	-		0G 2P 26.85	-	
ASSETTO MIS.	.000000	-		0G 0P .0S	-	
IMBARDATA	-.166535-01	.353708-02		0G-57P 15.0S	0G 12P 9.6S	-.934134-02
BECCHEGGIO	.217452-01	.100578-02		1G 14P 45.3S	0G 3P 44.0S	
ROLLIO	.695307-03	-.586672-02		0G 2P 23.4S	0G-29P 18.1S	
VOLANTE	.000000	.000000		0G 0P .0S	0G 0P .0S	.000000

$$$$$ R U O T E $$$$$

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	.000000	.000000	.000000	.000000
DERIVA	.893667-03	.400662-03	.897708-03	.616155-03
CONVERGENZA	.202912-05	.109050-03	-.182491-05	-.106320-03
CAMPANATURA	.458200-03	.100000-01	-.534906-03	-.100190-01
CAMP. RTF. AL SUOLO	.217755-01	.293090-01	.217461-01	-.284376-01
SCUOTIMENTO	.506925-02	.631417-01	.507704-02	.641432-01
VELOCITA' SCUOTIM.	-.313712-02	-.232541-03	-.117156-01	-.874973-02
VEL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	3070.81	3583.43	3006.91	3633.17
" LATERALE	-41.7367	-17.8002	-42.1934	-27.7733
" LONGITUDIN.	244.600	-49.5070	233.031	-58.6371
QUOTA PESO+CAR.SCUOT.	4300.70	3973.11	4349.13	4020.04
MOMENTO AUTOALLIN.	1.49048	.576583	1.53427	.911030
" RES. AL ROTOL.	16.1405	14.6719	16.3178	14.9081
" FRENANTE	.000000	.000000	.000000	.000000
VEL.CENTRO RUOTA	24.5048	24.5048	24.4907	24.4907
VEL.ROTAZ. RUOTA	81.5791	80.0762	81.4953	80.0566
SCORRIMENTO	.151433-01	-.332090-02	.143373-01	-.336554-02

$$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.	440.455	= 4202.43	GIRI/1'	• POTENZA DI ROTOLAMENTO	= 6.77306	CV
COPPIA	34.7350	= 3.54006	KGM	• POTENZA AERODINAMICA	= 9.26601	CV
POTENZA	15577.4	= 21.1722	CV			
FARFALLA	.310606					
COPPIA VOLANTE	-.146009	•	RISULTANTE FORZE EXT. BARIC.		.000000	
MARCIA INSERITA	3	•	RISULTANTE MOM. EXT. BARIC.		.000000	
PRESS.CIRC.FRENANTE	.000000	•	RISULTANTE COMP. VELOC. VENTO		.000000	

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.0000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.2203        RAGGIO EFFETTIVO      =  INFINITO   *
*   ACCELERAZIONE LATERALE  = -.231177-02G    CONTINGENZA EFFETTIVA =   .000000   *
*****************************************************************************
                              $$$$$ V E I C O L O $$$$$
X           =  68.4938          VINX   =  24.5849              AINX   =  .581234-01
Y           =  3.12745          VINY   = -.395348              AINY   = -.236471-01
Z           =  .327703-01       VINZ   =  .918660-03           AINZ   =  .578276-01
CURVATURA   = -.378032-04       VHORX  =  24.5822              AHORX  =  .572213-01
VELOCITA'   =  24.5001          VHORY  =  .540555-02           AHORY  = -.226705-01
RAGGIO      = -26452.8          VHORZ  =  .537825              AHORZ  =  .591812-01
PASSO INT.  =  .200000-01       PSTAR  = -.316894-02           PPUNTOS=  .164704-01
CONTINGENZA= -.231462-02        QSTAR  =  .220920-02           QPUNTOS=  .997888-02
INDICE FSV  =  .523242-02       RSTAR  =  .261500-02           RPUNTOS= -.846568-02

                          $$$$$ ANGOLI  VEICOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *     ANGOLI DI:        VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO    .214994-03        -        *   0G  0P 44.3$          -
ASSETTO MIS.    .000000           -        *   0G  0P   .0$         -
IMBARDATA      -.163465-01      .261621-02  *   1G-56P 11.7$      0G  8P 39.6$    -.846511-02
BECCHEGGIO      .219091-01      .220852-02  *   1G 15P 19.1$      0G  7P 35.5$
ROLLIO          .260675-03     -.311163-02  *   0G  0P 53.0$      0G-18P 41.0$
VOLANTE         .000000         .000000     *   0G  0P   .0$      0G  0P   .0$     .000000

                          $$$$$ R U O T E $$$$$
                    ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO               .000000          .000000         .000000          .000000
DERIVA               .349126-03      -.425839-04      .353222-03       .172876-03
CONVERGENZA          .283385-05       .108236-03     -.288871-05      -.107213-03
CAMPANATURA          .447743-03       .190884-01     -.477283-03      -.190425-01
CAMP. RIF. AL SUOLO  .219285-01       .202177-01     -.219186-01      -.288587-01
SCUOTIMENTO          .493536-02       .634433-01      .531351-02       .638188-01
VELOCITA' SCUOTIM.   .377725-03       .625701-02     -.417528-02       .173638-02
VEL. DEF. LAT. PNEUM.  .000000        .000000         .000000          .000000
CARICO  SCUOTIMENTO  3889.36          3687.51         3988.37          3821.10
  ''     LATERALE   -16.3564          1.91882        -16.5856         -7.77449
  ''     LONGITUDIN.  242.965        -49.9633         235.981         -58.6316
QUOTA PESO+CAR.SCUOT.  4329.86       3999.01         4342.78          4014.48
MOMENTO AUTOALLIN.   .992542         -.621063-01      .643282          .254338
  ''     RES. AL ROTOL.  16.2361      14.7857         16.2921          14.8511
  ''     FRENANTE     .000000          .000000         .000000          .000000
VEL.CENTRO RUOTA     24.5100          24.5100         24.5062          24.5062
VEL.ROTAZ. RUOTA     81.5815          80.8938         81.5297          80.8781
SCORRIMENTO          .149637-01      -.333171-02      .144903-01      -.336334-02

                        $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    448.556    =    4283.39   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.78932   CV
COPPIA                 34.7207    =    3.53932   KGM       * POTENZA AERODINAMICA   =  0.27344   CV
POTENZA                15574.2    =    21.1678   CV
FARFALLA               .310695
COPPIA VOLANTE        -.576212-01  *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA              3     *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE    .000000     *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T    =    2.0000              *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.2502      RAGGIO EFFETTIVO      =  INFINITO   *
*   ACCELERAZIONE LATERALE  =  .432597-03G  CONTINGENZA EFFETTIVA =  .000000    *
*****************************************************************************
                          $$$$$ V E I C O L O $$$$$
X          =  78.9446          VINX   =  24.5108          AINX   =  .581568-01
Y          =  3.00786          VINY   = -.396180          AINY   =  .330647-02
Z          =  .331814-01       VINZ   =  .513670-02       AINZ   =  .243982-01
CURVATURA  =  .786568-05       VMOBX  =  24.5078          AMOBX  =  .575418-01
VELOCITA'  =  24.9140          VMOBY  = -.000268-03       AMOBY  =  .424377-02
RAGGIO     =  141531.          VMOBZ  =  .540321          AMOBZ  =  .256795-01
PASSO INT. =  .200000-01       PSTAR  = -.231734-02       PPUNTOS=  .740285-02
CONTINGENZA=  .432826-03       QSTAR  =  .260837-02       QPUNTOS= -.103583-02
INDICE FSV =  .366413-02       RSTAR  =  .183162-02       RPUNTOS= -.600006-02

                      $$$$$ ANGOLI  VETCOLO $$$$$
            ANGOLI DI:      VELOCITA' DI:  *     ANGOLI DI:       VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO   -.368953-04        -        *     0G  0P -7.65        -
ASSETTO MIS.    .000000           -        *     0G  0P   .05       -
IMBARDATA      -.161255-01     .103206-02  *     0G-55P 26.15     0G  6P 17.95    -.600979-02
BECCHEGGIO      .221600-01     .260038-02  *     1G 16P 10.85     0G  0P 50.05
ROLLIO         -.146340-05    -.227674-02  *     0G  0P  -.35     0G -7P 49.65
VOLANTE         .000000        .000000     *     0G  0P   .05     0G  0P   .05     .000000

                          $$$$$ R U O T E $$$$$
                  ANT.SIN.        POST.SIN.        ANT.DES.        POST.DES.
STERZO             .000000          .000000          .000000          .000000
DERIVA             .564706-04      -.247323-03       .005271-04      -.356220-04
CONVERGENZA        .202400-05       .105055-03      -.202513-05      -.105061-03
CAMPANATURA        .463818-03       .190075-01      -.463653-03      -.190078-01
CAMP. RTF. AL SUOLO .221649-01      .201050-01      -.221649-01      -.201060-01
SCUOTIMENTO        .514006-02       .643170-01       .513703-02       .643140-01
VELOCITA' SCUOTIM. .340000-02       .104435-01       .171665-03       .715030-02
VEL. DEF. LAT. PNEUM. .000000       .000000          .000000          .000000
CARICO  SCUOTIMENTO 3994.58         3634.40          3988.19          3630.74
  ''    LATERALE   -2.65169         11.1455         -2.84120          1.60430
  ''    LONGITUDIN.  241.702       -58.3015          237.174         -58.7054
QUOTA PESO+CAR.SCUOT. 4345.63       4026.58          4341.08          4022.74
MOMENTO AUTOALLIN.  .966500-01      -.365000          .103417         -.526623-01
  ''    RES. AL ROTOL. 16.3001      14.9067          16.2869          14.8095
  ''    FRENANTE    .000000         .000000          .000000          .000000
VEL.CENTRO RUOTA    24.5153         24.5153          24.5126          24.5126
VEL.ROTAZ. RUOTA    81.5001         80.1090          81.5575          80.0091
SCORRIMENTO         .140319-01     -.333667-02       .145603-01      -.336125-02

                        $$$$$ P I L O T A G G I O $$$$$
VELOCITA' DI ROTAZ.    448.650   =   4284.29   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.815G4   CV
COPPIA                 34.7066   =   3.53780   KGM       * POTENZA AERODINAMICA   =  9.200006  CV
POTENZA                15571.1   =   21.1636   CV
FARFALLA               .310606
COPPIA VOLANTE        -.961407-02  *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA             3      *   RISULTANTE COPP. EXT. BARIC.      .000000
PRESS.CIRC.FRENANTE    .000000     *   RISULTANTE COMP. VELOC. VENTO     .000000
```

```
*****************************************************************************
*                                                                           *
*                    RISULTATI ALL' ISTANTE  T   =    3.0000               *
*                                                                           *
*****************************************************************************
*   VELOCITA' KM/H          =  80.2710      RAGGIO EFFETTIVO       =  INFINITO  *
*   ACCELERAZIONE LATERALE  =  .150849-026  CONTINGENZA EFFETTIVA  =  .000000  *
*****************************************************************************

                          $$$$$ V E I C O L O $$$$$

X           =  73.3959          VINX   =  24.5166          AINX   =  .578584-01
Y           =  3.04829          VINY   = -.395191          AINY   =  .147583-01
Z           =  .336863-01       VINZ   =  .906193-02       AINZ   = -.493194-02
CURVATURA   =  .260952-04       VMOBX  =  24.5135          AMOBX  =  .577113-01
VELOCITA'   =  24.5197          VMOBY  = -.362229-02       AMOBY  =  .156812-01
RAGGIO      =  38321.3          VMORZ  =  .555874          AMORZ  = -.383802-02
PASSO INT.  =  .200000-01       PSTAR  = -.015755-03       PPUNTOS=  .160540-01
CONTINGENZA=  .159927-02        QSTAR  =  .188452-02       QPUNTOS= -.111393-01
INDICE ESV  =  .245133-02       RSTAR  =  .122567-02       RPUNTOS= -.589085-02

                      $$$$$ ANGOLI  VEICOLO $$$$$

          ANGOLI DI:      VELOCITA' DI:   *      ANGOLI DI:        VELOCITA' DI:   ACCELERAZIONI DI:
ASSETTO VERO   -.143826-03        -        *   0G  0P-29.75          -
ASSETTO MIS.    .000000           -        *   0G  0P   .05          -
IMBARDATA      -.159740-01       .122566-02 *   0G-54P 54.99      0G  4P 12.85    -.389845-02
BECCHEGGIO      .223026-01       .188472-02 *   1G 16P 58.85      0G  6P 28.85
ROLLIO         -.167846-03      -.880311-03 *   0G  0P-34.65      0G -3P  3.29
VOLANTE         .000000          .000000    *   0G  0P   .05      0G  0P   .05     .000000

                          $$$$$ R U O T E $$$$$

                ANT.SIN.        POST.SIN.       ANT.DES.        POST.DES.
STERZO           .000000         .000000         .000000         .000000
DERIVA          -.819692-04     -.316826-03     -.779943-04     -.118498-03
CONVERGENZA      .197146-05      .183848-03     -.288927-05     -.183784-03
CAMPANATURA      .495584-03      .189323-01     -.476928-03     -.189582-01
CAMP. RIF. AL SUOLO .223958-01   .292159-01     -.224816-01     -.294441-01
SCUORIMENTO      .555231-02      .653496-01      .538881-02      .651879-01
VELOCITA' SCUORIM. .433496-02    .937283-02      .382445-02      .887198-02
VEL. DEF. LAT. PNEUM. .000000    .000000         .000000         .000000
CARICO  SCUORIMENTO 3916.91      3654.64         3982.17         3541.27
  ''    LATERALE    3.85627      14.3287         3.65199         4.96687
  ''    LONGITUDIN. 249.749      -58.7246        237.881         -58.8976
QUOTA PESO+CAR.SCUOT. 4358.79    4047.88         4342.91         4033.39
MOMENTO AUTOALLIN. -.141134      -.473751        -.133356        -.163971
  ''    RES. AL ROTOL. 16.3686   15.8811         16.2973         14.9377
  ''    FRENANTE    .000000      .000000         .000000         .000000
VEL.CENTRO RUOTA  24.5206        24.5206         24.5198         24.5189
VEL.ROTAZ. RUOTA  81.5973        80.1268         81.5813         80.1196
SCORRIMENTO      .147288-01     -.334178-02      .146866-01     -.335917-02

                      $$$$$ P I L O T A G G I O $$$$$

VELOCITA' DI ROTAZ.   448.741    =   4285.16   GIRI/1'   * POTENZA DI ROTOLAMENTO =  6.84857   CV
COPPIA                34.6931    =   3.53658   KGM       * POTENZA AERODINAMICA   =  9.28663   CV
POTENZA               15568.2    =   21.1596    CV
FARFALLA              .319696
COPPIA VOLANTE        .132814-01 *   RISULTANTE FORZE EXT. BARIC.      .000000
MARCIA INSERITA            3     *   RISULTANTE MOM. EXT. BARIC.       .000000
PRESS.CIRC.FRENANTE   .000000    *   RISULTANTE COMP. VELOC. VENTO     .000000
```

APPENDIX A.3-2

CURVMAGN COMPUTER SIMULATION MODEL

APPENDIX A.3-3

CURVMAGNCAR COMPUTER SIMULATION MODEL

APPENDIX A.3-4

PRESTMCC COMPUTER SIMULATION MODEL

The CURVMAGN program provides the values of the various magnetic quantities in the different sections in which the magnetic circuit of the DC electric machine is divided. The no-load magnetization curve is plotted, once the geometrical quantities of the magnetic circuit, the magnetic characteristic curve of the laminations and of the iron used are known together with the Lehman diagram at no-load relative to the salient pole and assuming the necessary approximations for what non-linear magnetic phenomena are concerned.

Simulation of the magnetization curve of a DC electric machine has proved to be reliable, after comparison with that obtained by means of the experimental data relative to a DC compensated electric machine.

The CURVMAGNCAR program provides the values of flux distribution in the air gap and draws by means of a plotter the magnetization curve under load conditions for all the values of current considered, once the geometric quantities of the magnetic circuit, the magnetic characteristic of the laminations, the Lehman diagram at load relative to the salient pole, the degree of compensation and the auxiliary poles excitation are known.

The PRESTMCC program provides the mechanical power curves versus motor speed as in motoring as in generating conditions, at different values of armature current with the following input data: supply voltage, geometric and magnetic quantities of the electric machine.

Furthermore this program provides the efficiency map of the motor/generator DC machine.